Bandelier National Monument

National Park Service
US Department of the Interior

Bandelier National Monument Fire Management Plan Environmental Assessment / Assessment of Effect

October 2004

National Park Service
Contact information:

Darlene M. Koontz - Superintendent
HCR 1, Box 1, Suite 15
Los Alamos, NM 87544

Gary Kemp - Fire Management Officer
HCR 1, Box 1, Suite 15
Los Alamos, NM 87544

TABLE OF CONTENTS

Chapter 1
PURPOSE AND NEED FOR ACTION

INTRODUCTION

Restoring fire, a natural disturbance process, to its historic role at Bandelier is one of the Monument's highest management priorities (see Appendix C for a detailed description of fire ecology in Bandelier and the Jemez Mountains). Bandelier's 1997 Fire Management Plan (FMP) provided the framework and guidance to achieve the Monument's fire and resource management goals and objectives in accordance with applicable policies and regulations. However, the National Park Service (NPS) Federal Wildland Fire Management Policy (NPS, 2003) has been revised and the conditions and scientific knowledge of Bandelier's ecosystems have changed. Many factors, including the continued accumulation of forest fuels and widespread tree mortality due to insect infestations and persistent drought, have initiated substantial changes in Bandelier's ecosystems since the 1997 FMP was finalized. Due to these landscape- scale changes and the evolution of the NPS Fire Program, Bandelier is initiating a review of their 1997 FMP.

The National Environmental Policy Act (NEPA) requires land managers to consider the potential effects of proposed actions to the environment. This Bandelier National Monument Fire Management Plan Environmental Assessment (EA)/Assessment of Effect proposes four alternatives for managing wildland and prescribed fire, maintaining and restoring ecosystems, reducing hazardous fuels, and protecting natural and cultural resources in the Monument. It also examines the environmental impacts of each alternative. At the conclusion of the NEPA process, one alternative will be selected to form the fundamental core of Bandelier's new fire management plan. This plan will be the working document for guiding wildland fire management actions and activities in Bandelier. In accordance with the parameters established by the new plan, Bandelier's fire management personnel will implement safe fire management activities to accomplish fire and resource management goals and objectives and to reduce the risk of unwanted fire within and adjacent to the Monument. Strategies for implementation will be based on knowledge gained from fire and fuels research, monitoring, and experience in Bandelier over the last half century.

This Bandelier Fire Management Plan/EA was prepared in compliance with the requirements of NEPA, the National Historic Preservation Act (NHPA) of 1966 (as amended), the Endangered Species Act (ESA) of 1973, as amended, and the Wild and Scenic Rivers Act. The legal authority for preparing and implementing the Bandelier Fire Management Plan is the 1916 Organic Act for the National Park Service: 16 United States Code (USC) 1 through 4.

General Site Description

Geography

Bandelier National Monument is located on the southern portion of the Pajarito Plateau in the Jemez Mountains at the southern edge of the Rocky Mountains in north- central New Mexico. It is approximately 10 miles southwest of Los Alamos and 50 miles northwest of Santa Fe (Figure 1.1). The Monument's northern boundary is situated on the rim of a large volcano (now the Valles Caldera National Preserve) that collapsed approximately one million years ago after its enormous eruption (Figure 1.2). The area is now composed of volcanic ash and lava flows that have been eroded into deep canyons separated by narrow mesas. Within the Monument's boundaries are 33,727 acres (approximately 15,740 hectares) of rugged canyons, mesas, and mountain slopes. The Monument spans an elevational gradient from the Rio Grande at 5,300 ft (1,590 meters) to the summit of Cerro Grande at 10,199 ft (3,109 meters), an altitudinal range of 4,899 ft. (1,519 meters).

Geology

Cerro Grande, a volcanic dome of the Tschicoma formation, lies on the southeast perimeter of the Valle Grande. This mountain, along with many in the Jemez Mountains, was formed prior to several major volcanic eruptions in the area, although additional volcanic domes have formed subsequently. At least two of the eruptions formed calderas that appear today in the heart of the Jemez Mountains. These broad green valleys prompted their first discoverers to name these mountains the Sierras de los Valles. The younger, larger caldera, the Valle Grande, truncates the older, smaller caldera, the Valle Toledo. Below the Cerro Grande, pyroclastic ash flow deposits of Bandelier Tuff spread out in a southeasterly direction toward the Rio Grande and are measured in thickness of up to 1000 ft (approximately 300 meters). Near the Rio Grande, the Tuff overlies Cerros de Rio basalts. The eastern fan of the Bandelier Tuff is referred to as the Pajarito Plateau.

Streams have formed deep erosional canyons in the Bandelier Tuff. These canyons from north to south are: Frijoles, Lummis, Alamo, Hondo, Capulin, Medio, and Sanchez (Figure 1.3). In the upper reaches of the first five canyons, erosion has exposed andesites of the Paliza Canyon Formation. These andesites are also exposed in the middle portions of the Medio and Sanchez canyons. Cerros del Rio basalts are exposed in most of the canyons near the Rio Grande. In the lower part of Capulin Canyon, sediments of the Santa Fe Formation are exposed.

Figure 1.1 Bandelier National Monument

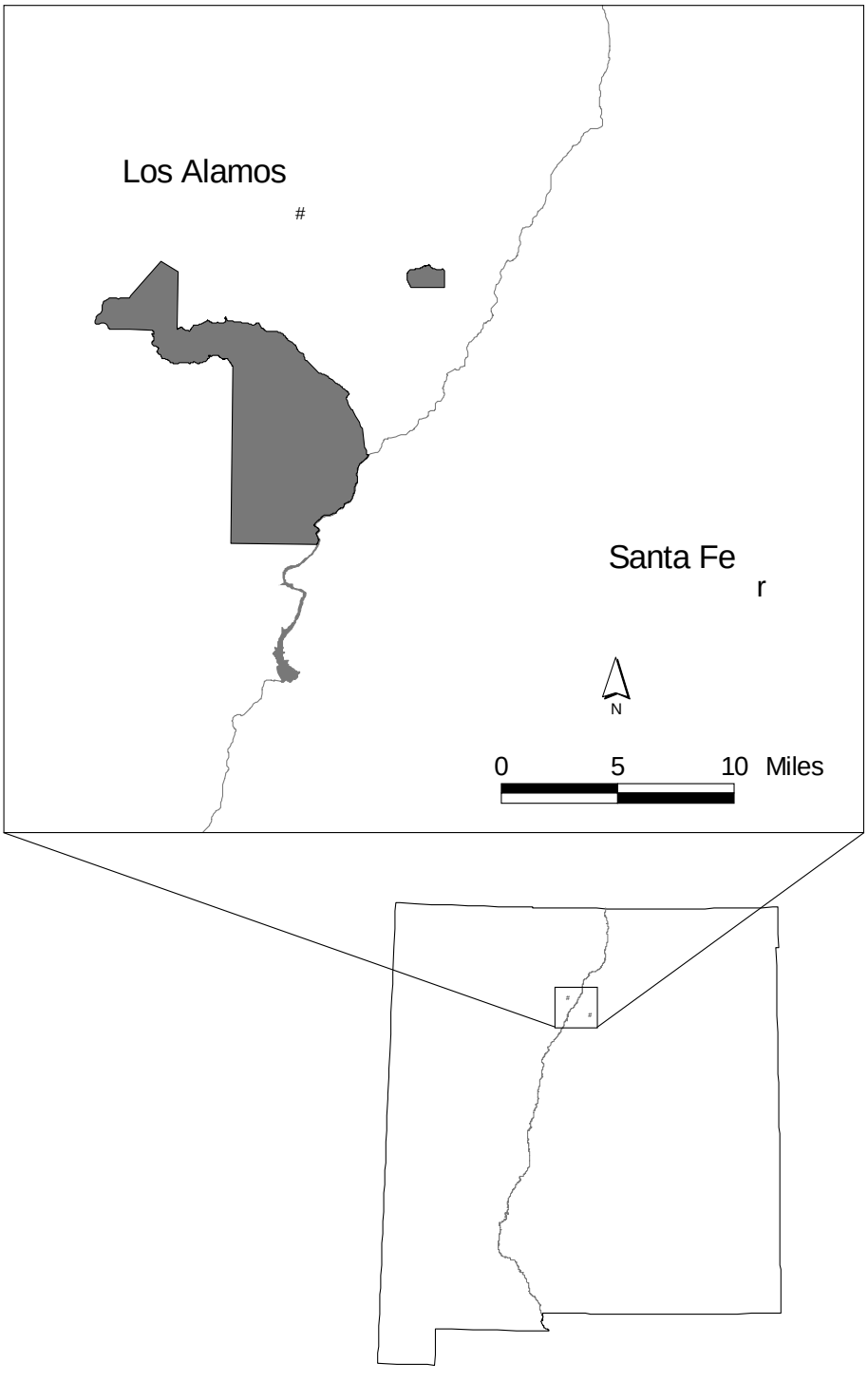
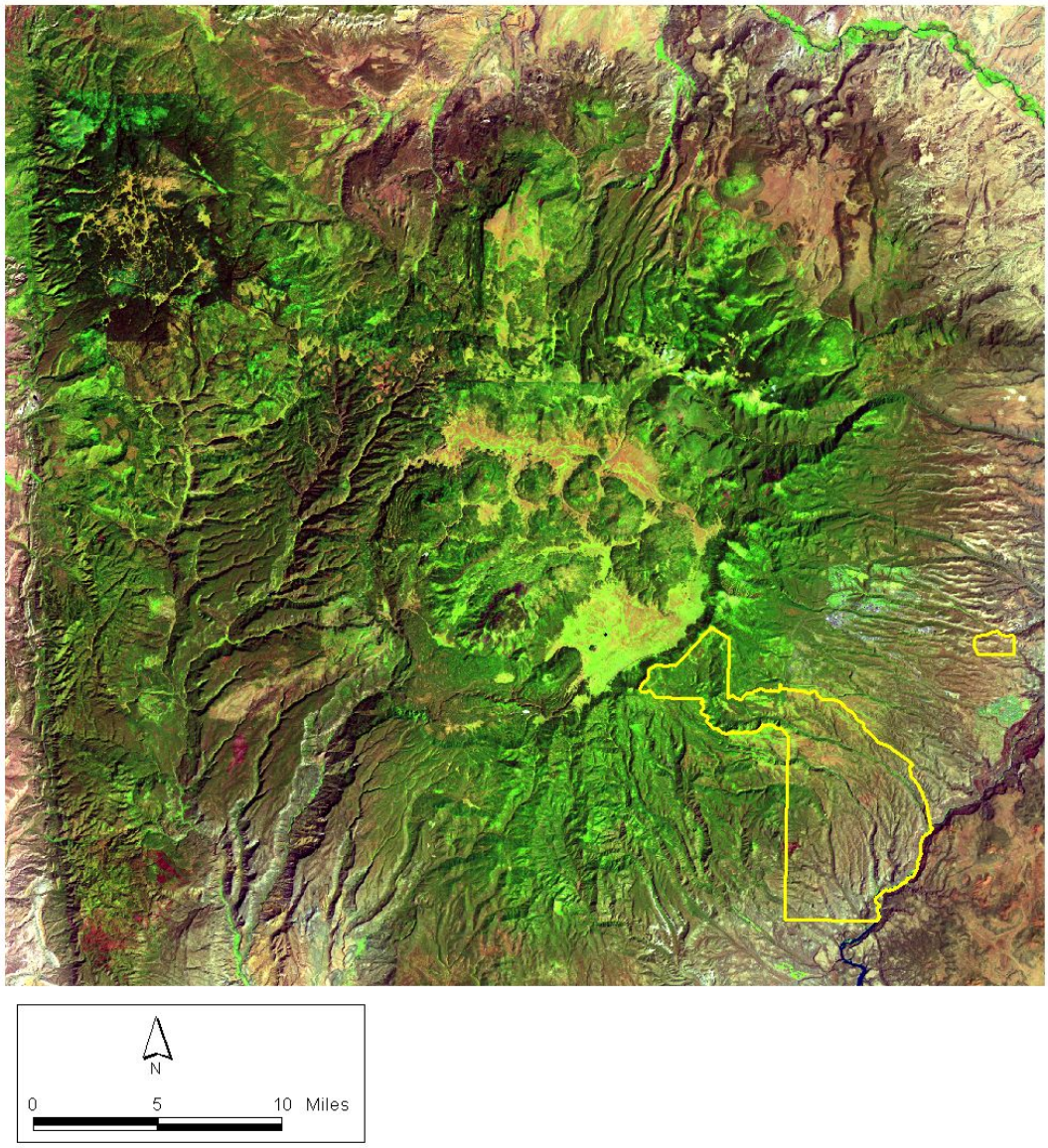
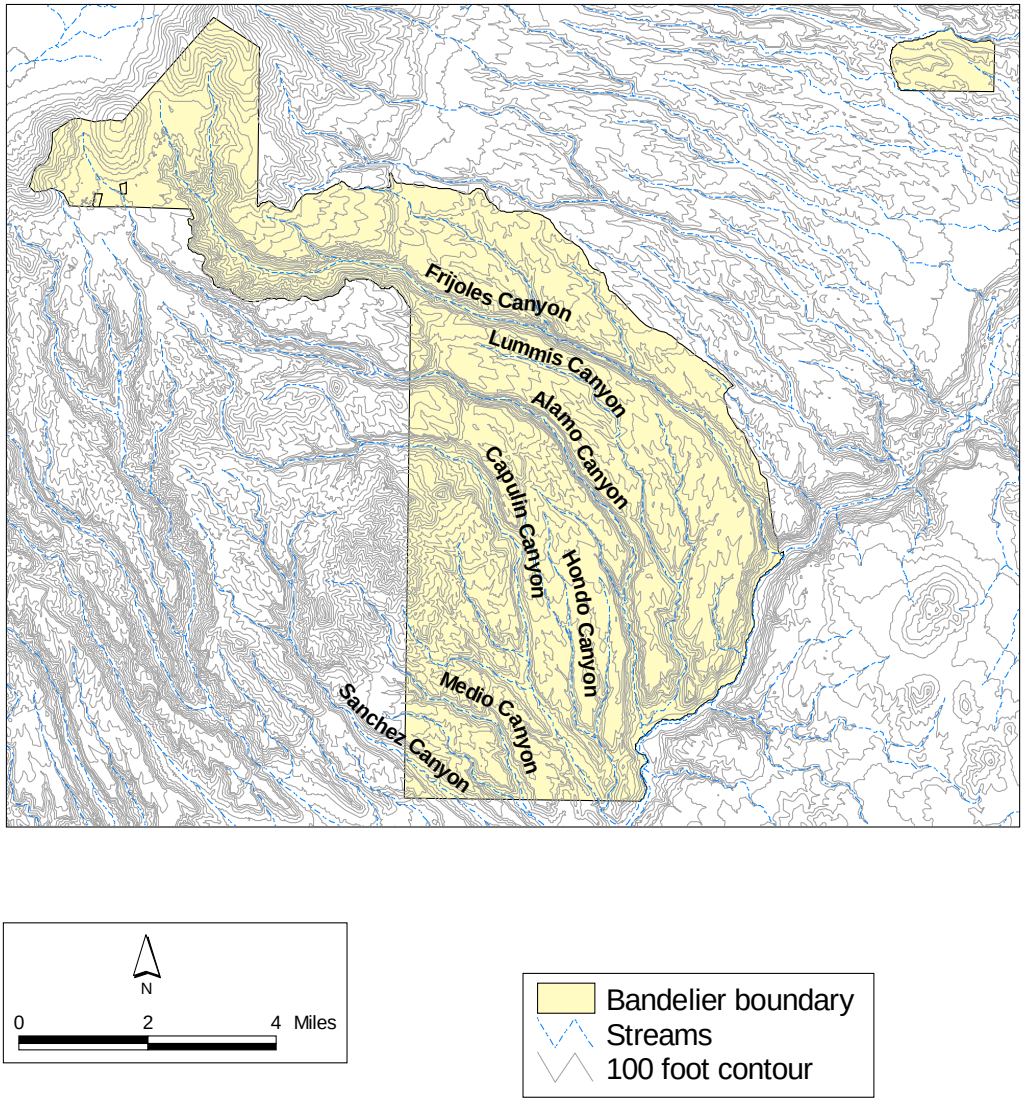


Figure 1.2 Bandelier National Monument and the Valles Caldera in the Jemez Mountains



9/10/04 K.Beeley, Bandelier National Monument

Figure 1.3 Streams and Canyons in Bandelier National Monument



9/27/04 K.Beeley, Bandelier National Monument

Climate

The climate within Bandelier National Monument is very localized depending on elevation and topographic aspect. Precipitation generally increases with elevation, although considerable variation is introduced by the erratic nature of thunderstorms during the summer months. The spring months of April – June are normally dry and summer months of July – August are wet, with afternoon thunderstorms common. The historic (69- year average) average yearly precipitation is 16.17 inches (in). The average annual precipitation from 1998 – 2003 was 11.47 in., with 2001 – 2003 averaging only 8.92 in. per year.

Normally a snow pack is formed during the winter months at the higher elevations, increasing stream flow considerably during the spring snow melt. Snow also falls at the lowest elevations, but typically does not persist. Temperatures range generally between a low of 0.0° Fahrenheit (F) in the winter months to a high of 100° F during summer, although extremes above or below are not uncommon. Diurnal temperature differences are typically near 30° F.

Significance of Bandelier National Monument

The diversity of habitats created by the range of elevations, topographic aspects, climates, and soils support a variety of associated wildlife, such as elk, black bear, and mountain lion, and are populated by an equally diverse assemblage of plant life. Thus, within a single days' walk from the banks of the Rio Grande to the summit of Cerro Grande, one traverses moist canyon bottoms, juniper grassland communities, pinyon- juniper woodlands, ponderosa pine forests, mixed conifer forests, and mountain meadows. Bandelier contains over 750 taxa of vascular plants, including many sensitive species such as the yellow lady's slipper (*Cypripedium calceolus*) and grama grass cactus (*Pediocactus papyracanthus*).

The primary reason Bandelier was designated a National Monument in 1916 was to preserve and protect its high concentration of cultural resources. The presidential proclamation that created Bandelier National Monument states: "…certain prehistoric aboriginal ruins…are of unusual ethnological, scientific, and educational interest…and that the public interest would be promoted by preserving these relics of a vanished people." The Monument contains approximately 2,805 recorded archeological sites that span in time from the Paleoindian period (10,000 years ago) to the historic period (from 1600 to present). The Monument includes ancient hunting camps, "cavate" structures (rooms that have been carved into the soft tuff bedrock), 300- room pueblos, small farming hamlets, and the remains of historic corrals and log cabins, as well as other cultural resources. Bandelier is also home to the largest collection of Civilian Conservation Corps (CCC) era buildings, which are preserved in the Bandelier National Monument CCC Historic District. This National Historic Landmark commemorates the accomplishments of the CCC and its contributions to the history of the National Park Service.

PURPOSE OF ACTION

Fire management plans are fundamental strategic documents that guide the full range of fire management related activities. They are required by the National Park Service Director's Order 18 (DO- 18), Wildland Fire Management (NPS, 2003), which says: "Every park area with burnable vegetation must have a fire management plan approved by the superintendent," and the 2001 Federal Wildland Fire Management Policy, which reiterates: "Complete, or update, fire management plans for all areas with burnable vegetation."

The purpose of this action is to design and implement a new fire management plan at Bandelier National Monument. This will be accomplished through the collective effort of an interdisciplinary team, with input from the public. The approved plan will serve as an operations manual and will provide a framework for making fire and fuels management decisions. It will also identify and describe fire and resource management goals and objectives as listed in this chapter under the section titled "Bandelier's Fire Management Program Goals and Objectives."

NEED FOR ACTION

The Presidential Proclamation (No. 1322) that established Bandelier National Monument on February 11, 1916 stated that "…certain prehistoric aboriginal ruins…are of unusual ethnological, scientific, and educational interest…and that the public interest would be promoted by preserving these relics of a vanished people, with as much land as may be necessary for the proper protection thereof…" Accordingly, the Organic Act of 1916 and ther NPS policies and Director's Orders require that the NPS serve as land stewards to Bandelier National Monument, protecting the natural and cultural resources in perpetuity. Furthermore, NPS DO- 18 (NPS, 2003) requires that all park units with vegetation that can sustain fire have a written fire management plan that addresses natural and cultural resource fire issues and is responsive to park needs. All fire management plans must also meet the terms of NEPA.

To comply with these policies and guidelines, it is imperative that Bandelier design and implement a fire management plan that considers advances in fire science knowledge; new technologies and fire- fighting techniques; long- term solutions to new and current resource challenges; the most current science- based research and monitoring, and new information about sensitive, threatened, or endangered species. This plan must also take into account changes that have occurred to Monument resources since the 1997 FMP such as landscape-scale tree mortality due to drought conditions and beetle infestations.

FIRE AND FUELS MANAGEMENT AT BANDELIER

Fire History

Fire and fuels management at Bandelier is an essential component of protecting, preserving, and restoring the Monument's natural and cultural resources. All of the Monument's vegetation communities and wildlife habitats have evolved under the influence of periodic fires, and many of the plants that have persisted through these episodic fire events, such as native perennial grasses, now require fire to stimulate reproduction and growth.

Fire also plays an important role in maintaining the structure, species composition, and functional integrity of ecosystems and landscapes. For example, recurrent, low intensity surface fires historically maintained Bandelier's ponderosa pine forests in an open canopy condition with abundant grasses and forbs in the understory (Allen, 1989). With this frequent low intensity fire regime, horizontal and vertical forest fuels were maintained at low levels and understory tree density was low. This limited the spread of fire into the tree canopies and reduced the frequency of stand- replacing fire events.

The pre and proto- historic people responsible for creating the Monument's archeological resources also lived in this frequent fire environment. Their material remains have withstood minimal damage for more than 700 years. Repeated, low intensity fire protected the sites by continually removing surface fuels and other materials that, in the absence of fire, can accumulate and promote high intensity fires that can damage cultural materials and cultural site components. Additionally, a low intensity fire regime protected the sites from erosion by enhancing the vegetative cover and stabilizing soils.

It is also important to consider that using fire as a management tool is not a new concept. Native Americans were in the practice of using fire to alter and maintain the landscape of the area that is now Bandelier. Their use of fire most likely affected fire pattern and occurrence to some degree, but probably did not affect the fire regime (Allen, 2002), and therefore the ecological integrity of Bandelier's natural resources as a whole.

The frequent and widespread fire activity that maintained Bandelier's natural and cultural resources persisted until the late 1800's, when extensive grazing and timber extraction began. Distinct declines in fire frequency and occurrence took place throughout the Jemez Mountains at this time. After the cessation of grazing, fire would have continued to occur throughout the area, but an effective campaign to suppress all fires began around 1910. The cessation of naturally occurring fires has altered most of the vegetation communities in Bandelier (Allen, 1989).

See Appendix C for a detailed description of fire ecology in Bandelier and the Jemez Mountains.

Fire and Developed Areas

Bandelier is located approximately 10 miles (by State Road 4) southwest of the town of Los Alamos, home of the Los Alamos National Laboratory, and 9 miles west of White Rock town site. There are also several smaller communities scattered throughout the Jemez Mountains that are in the vicinity of the Monument's northern and western boundaries. Additionally, the Monument contains developed areas such as visitor use facilities, employee offices, employee housing, picnic areas, campgrounds, and front country hiking trails.

The close proximity of Bandelier to these town sites, communities, lab technical areas, and other developed areas requires special consideration in the development of a fire management plan. Smoke emissions, air quality, extreme fire behavior, and fire escape are of particular concern.

Bandelier's Wildland Fire Use for a Resource Benefit and Prescribed Fire Programs

Bandelier began using prescribed fire to restore ecosystems and reduce fire hazard in 1976 and has since then conducted approximately 35 prescribed burns in nearly all of Bandelier's vegetation communities (Lissoway, personal communication, 2004). Data collected by Bandelier's Fire Ecology Program before and after these prescribed fires indicates that the Fire Management Program has been successful in reducing fuel accumulations and understory tree densities in several areas. For example, analysis of 12 plots in Bandelier's lower elevation ponderosa pine forests show a reduction in total fuel load from 27.7 tons/acre in preburn to 7.2 tons/acre immediately postburn. Understory tree densities were reduced from 56 trees/acre at preburn to 20 trees/acre at two years postburn. Total fuel load was also reduced in a recovering ponderosa pine area (The La Mesa Fire Area) from 29.0 tons/acre at preburn to 8.8 tons/acre immediately postburn. The understory tree density in this area was recorded at 115 trees/acre at preburn and reduced to 79 trees/acre at 2 years postburn (Fire Effects Monitoring, unpublished data).

The management of naturally ignited wildland fire is referred to as "Wildland Fire Use for a Resource Benefit (WFURB). Bandelier began managing naturally ignited wildland fires in 1984, when a fire started on the mesa between Frijoles and Lummis canyons and burned approximately 15 acres (Lissoway, personal communication, 2004). In 1997, a naturally ignited fire was again managed in the Lummis Canyon area.

REGULATIONS AND POLICIES

Wildland fire management activities conducted by the NPS are guided by National Park Service Management Policies (2001a), and the 2001 Federal Fire Policy. DO- 18 guides the development of NPS policy relative to fire management, and dictates the program requirements for fire management plans. These requirements are listed in Table 1.1. The Bandelier Fire Management Plan/EA has been prepared in accordance with relevant policies and guidelines.

National Park Service Management Policies

Table 1.1 National Park Service fire management program requirements

National Park Service policy directing development of fire management plans—Director's Order 18: Wildland Fire Management Section 5: Program Requirements
Every park area with burnable vegetation must have a fire management plan approved by the Superintendent.
All approved fire management plans will: • Reinforce the commitment that firefighter and public safety is the first priority. • Describe wildland fire management objectives, which are derived from land, natural, and cultural resource management plans and address public health issues and values to be protected. • Address all potential wildland fire occurrences and consider the full range of wildland fire management actions. • Promote an interagency approach to managing fires on an ecosystem basis across agency boundaries and in conformance with the inherent ecological processes and conditions characteristic of the ecosystem. • Include a description of rehabilitation techniques and standards that comply with resource management plan objectives and mitigate immediate safety threats. • Be developed with internal and external interdisciplinary input and reviewed by appropriate subject matter experts and all pertinent interested parties, and approved by the park Superintendent. • Comply with NEPA and any other applicable regulatory requirements. • Include a wildland fire prevention analysis and plan. • Include a fuels management analysis and plan. • Include procedures for short- and long- term monitoring to document that overall programmatic objectives are being met and undesired effects are not occurring.

Federal Wildland Fire Management Policy

The Interagency Federal Wildland Fire Policy Review Working Group revised the Federal Wildland Fire Management Policy in 2001. Bandelier's 1997 FMP was based on the 1995 Federal Wildland Fire Management Policy (hereafter, 1995 Federal Fire Policy)

and the new FMP will be based on the 2001 Federal Fire Policy. This policy's main elements are listed in Table 1.2

Table 1.2 Main Elements of the 2001 Federal Wildland Fire Management Policy

Policy Element	Policy
Safety	Firefighter and public safety is the first priority. All fire management plans and activities must reflect this commitment.
Ecosystem Sustainability	The full range of fire management activities will be used to help achieve ecosystem sustainability including its interrelated ecological, economic, and social components.
Response to Wildland Fire	Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on the ecological, social, and legal consequences of the fire. The circumstances under which a fire occurs, and the likely consequences for firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response to the fire.
Use of Wildland Fire	Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on approved fire management plans and will follow specific prescriptions described in operational plans.
Rehabilitation and Restoration	Rehabilitation and restoration efforts will be undertaken to protect and sustain ecosystems, public health, and safety, and to help communities protect infrastructure.
Protection Priorities	The protection of human life is the single, overriding priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be based on the values to be protected, human health and safety, and the costs of protection. Once people have committed to an incident, these human resources become the highest value to be protected.
Wildland/Urban Interface	The operational roles of federal agencies as partners in the wildland/urban interface are wildland firefighting, hazardous fuels reduction, cooperative prevention and education, and technical assistance. Federal agencies may assist with exterior structural protection activities under formal Fire Protection Agreements that specify mutual responsibilities of the partners, including funding. (Some federal agencies have full structural protection authority for their facilities on lands they administer; they may also enter into formal agreements to assist state and local governments with full structural protection.)

Policy Element	Policy
Planning	Every area with burnable vegetation must have an approved fire management plan. Fire management plans are strategic plans that define a program to manage wildland and prescribed fires based on the area's approved land management plan. Fire management plans must provide for firefighter and public safety; include fire management strategies, tactics, and alternatives; address values to be protected and public health issues; and be consistent with resource management objectives, activities of the area, and environmental laws and regulations.
Science	Fire management plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors. Information needed to support fire management will be developed through an integrated interagency fire science program. Scientific results must be made available to managers in a timely manner and must be used in the development of land management plans, fire management plans, and implementation plans.
Preparedness	Agencies will ensure their capability to provide safe, cost- effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, equipment, and management oversight.
Suppression	Fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.
Prevention	Agencies will work together and with their partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.
Standardization	Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values- to-be- protected methodologies, and public education programs for all fire management activities.
Interagency Cooperation and Coordination	Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.
Communication and Education	Agencies will enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education programs. These programs will be continuously improved through the timely and effective exchange of information among all affected agencies and organizations.
Agency Administrator and Employee Roles	Agency administrators will ensure that their employees are trained, certified, and made available to participate in the wildland fire program locally, regionally, and nationally as the situation demands. Employees with operational, administrative, or other skills will support the wildland fire program as necessary. Agency administrators are responsible and will be held accountable for making employees available.

Policy Element	Policy
Evaluation	Agencies will develop and implement a systematic method of evaluation to determine the effectiveness of projects begun under the 2001 Federal Wildland Fire Management Policy. The evaluation will assure accountability, facilitate resolution of areas of conflict, and identify resource shortages and agency priorities.

Other Relevant Regulations and Policies

Table 1.3 Other relevant regulations and policies listed by topic

Topic	Relevant Regulations and/or Policies
Air Quality	Federal Clean Air Act; Clean Air Act Amendments of 1990; National Park Service Management Policies, 2001
Endangered or Threatened Species and Their Habitats	Endangered Species Act; National Park Service Management Policies, 2001
Soils	National Park Service Management Policies, 2001
Vegetation	National Park Service Management Policies, 2001
Water Quality and Hydrology	Clean Water Act; Executive Order 12088; National Park Service Management Policies, 2001
Wetlands and Floodplains	Executive Order 11988; Executive Order 11990; Rivers and Harbors Act; Clean Water Act; National Park Service Management Policies, 2001
Wilderness	Director's Order 41; National Park Service Management Policies, 2001
Wildlife	National Park Service Management Policies, 2001
Cultural Resources	National Historic Preservation Act; Section 106; 36 CFR 800; Executive Order 13007; Director's Order 28; National Park Service Management Policies, 2001
Economics	40 CFR 1500 Regulations for Implementing NEPA
Energy Requirements and Conservation Potential	National Park Service Management Policies, 2001
Environmental Justice	Executive Order 12898
Indian Trust Resources	Department of the Interior Secretarial Order No. 3206 and Secretarial Order No. 3175

Topic	Relevant Regulations and/or Policies
Public Health and Safety	National Park Service Management Policies, 2001
Sustainability and Long-term Management	NEPA, 40 CFR 1500 Regulations for Implementing NEPA, National Park Service Management Policies, 2001
Visitor Use and Experience	Organic Act; National Park Service Management Policies, 2001

Changes in National Fire Policy since Bandelier's 1997 Fire Management Plan

The 1995 Federal Fire Policy was the first comprehensive statement of wildland fire policy coordinated between the Departments of the Interior and Agriculture. It provided clear direction on important issues of safety, the role of fire in natural resource management, and the relative roles of federal and non- federal agencies in the Wildland Urban Interface. The policy was developed in response to several incidents, including the severity of the 1994 fire season, during which 34 firefighters died.

The 1995 Federal Fire Policy recognized and emphasized the essential role of fire in maintaining natural ecosystems. As a result, federal agencies substantially increased the use of wildland fire to treat fuels and restore natural systems. The Cerro Grande Fire, initiated to treat fuel accumulations and restore montane grasslands and aspen stands, was a prescribed fire that escaped Bandelier boundaries and eventually burned 48,000 acres and hundreds of homes in Los Alamos. In the aftermath of this fire, the Secretaries of Interior and Agriculture requested that the group who developed the 1995 Federal Fire Policy reconvene and evaluate the policy and the status of its implementation to make recommendations for improvements. The Working Group, consisting of representatives of twelve federal agencies and the National Association of State Foresters, represents the consensus of top wildland fire and natural resource management professionals on how to best address wildland fire management on federal lands.

After careful review, the Working Group concluded that the 1995 Federal Fire Policy is generally sound and provides a solid foundation for wildland fire and natural resource management activities of the federal government. However, as a result of the experiences since 1995, as well as greater understanding of the complexity and seriousness of the wildland fire situation in this country, the Working Group determined that some elements of the policy needed clarification of purpose and intent and that some issues were not fully covered.

The review and update of the 1995 Federal Fire Policy sought to build on the strengths of the original policy while addressing its weaknesses. As a result, the Working Group revised one of the guiding principles, revised and added several policy statements, and developed eleven implementation actions. The resulting document is the 2001 Federal Fire Policy and replaces the 1995 Federal Fire Policy.

The revisions and additions to the 1995 Federal Fire Policy are explained below:

Guiding principles:
The guiding principles of the 2001 Federal Fire Policy are the same as in the original 1995 policy, with one exception. The word "international" has been added to the principle pertaining to coordination and cooperation to recognize the increasing role that other countries play in assisting the United States (U.S.) as well as the increasing exchange of technology, training, skills, and knowledge of wildland fire issues between the U.S and other countries.

Key points of the policy statement revisions:

- Increase recognition that fire management plans identify and integrate all fire management and related activities within the context of approved land management plans.
- Clearly state that the management response to fire is based on the circumstances surrounding the fire, not the source of ignition or location of the fire.
- Clarify that, following protection of human life, suppression priority decisions include considerations of human health and consequences on communities rather than property.
- Clarify that the policy on Wildland Urban Interface (WUI) states that the role of wildland fire agencies is in protecting structures from fire, but not in suppressing fires in the WUI.
- Emphasize that a broad cross section of employees, not just dedicated fire management personnel, need to be trained, certified, and available for wildland fire assignment and that all employees will be available to support wildland fire if the situation demands.

Key issues of new policy statements:

- The role of fire in ecosystem sustainability.
- The need for restoration and rehabilitation of fire damaged lands and ecosystems.
- The role of science in developing and implementing fire management programs.
- The importance of communication and education internally and externally.
- The critical need for regular, ongoing evaluation of policies and procedures.

Summary of new implementation actions:

1. Fire management and ecosystem sustainability
   - Develop a comprehensive, interagency strategy for fire management to help achieve ecosystem sustainability.
   - Fire management plans and land management plans will appropriately incorporate mitigation, burned- area rehabilitation, and fuels reduction and restoration activities that contribute to ecosystem sustainability.
2. Response to wildland fire
   - Base responses to wildland fires on approved fire management plans and land management plans, regardless of ignition source or the location of the ignition.

3. Wildland Urban Interface
   - Accelerate and expand ongoing efforts, such as the FIREWISE program, to increase public awareness of the risks of building and living in the WUI.
   - Accelerate and expand efforts to identify WUI areas that lack formal structural fire protection, and encourage states and local communities to form rural fire departments where none exist.
4. Planning
   - Complete or update fire management plans for all areas with burnable vegetation.
5. Science
   - Continue to develop science programs to provide the foundation for land and fire management plans and activities. These programs must address the land and fire management information needs of land managers, conduct basic and applied research, transfer information to end users, and ensure that appropriate results are applied and implemented.
   - Develop coordinated databases for federal fire information that support fire program development and implementation of the 2001 Federal Fire Policy.
6. Workforce and organization
   - Develop an interagency strategy for wildland fire workforce management.
   - Review the structure of fire management and fire suppression organizations.
7. Funding
   - Provide full funding for fire management and associated programs to ensure successful implementation of the 2001 Federal Fire Policy.
8. Communication and education
   - Develop a national interagency communication and education program to enhance understanding of the fire management mission for both internal and external audiences.
9. Program management and coordination
   - Establish a mechanism for coordinated interagency and interdisciplinary oversight of implementation of the 2001 Federal Fire Policy.
10. Evaluation
    - Establish clear mechanisms for evaluating the 2001 Federal Fire Policy and its implementation.
11. 1995 Federal Fire Policy Action Items
    - Complete implementation of Action Items recommended from the 1995 Report in accordance with the 2001 Federal Fire Policy and the implementation items in this review and update.
    - Expand the regular and ongoing participation in the fire program management and implementation to all federal agencies with fire- related capabilities and responsibilities.
    - Improve coordination among federal, state, tribal, and local organizations.
    - Standardize and implement operational policies and procedures.
    - Develop a national plan for weather services that provides products, standards, and services to support the full range of responses required by both federal and state wildland fire management agencies.

The 2001 Federal Fire Policy greatly expands the number of agencies that work together on wildland fire management to include those with land management responsibilities, those with supporting programs in science, information, and technology, and those with regulatory activities that directly affect fire management. The 2001 Federal Fire Policy will ensure more consistent wildland fire management on federal lands across the country because it will for the

first time apply to Department of Defense and Department of Energy as well as the Departments of Agriculture and Interior.

BANDELIER'S FIRE AND RESOURCE MANAGEMENT GOALS AND OBJECTIVES

Bandelier's Fire Management Program seeks to safely and effectively manage wildland and prescribed fires, while providing for the protection of life, property, and the Monument's natural and cultural resources. The program's aim is to recover, maintain, increase, and facilitate the interaction of native ecosystem processes in an effort to restore and perpetuate the native diversity, resiliency, resistance, and sustainability of Bandelier's natural environments. The program is based on the most up to date scientific research and monitoring (at a variety of spatial scales), and considers past and present human disturbances and effects on the natural and cultural environment. The fire program is also based on the adaptive management concept and therefore implements deliberate and measurable actions that are monitored to determine if the conditions produced are favorable, sustainable, and maintain or improve ecosystem health.

Bandelier's Fire Management Plan, when completed, will prescribe actions necessary to implement Servicewide fire management policies (DO- 18) (NPS, 2003) and to achieve the Monument's fire and resource management goals and objectives. The following fire and resource management goal is identified in Bandelier's Resource Management Plan (NPS, 1995), Fire Management Plan (NPS, 1997), and Strategic Plan (NPS, 2000a):

1. Provide the means for staff and the public to preserve, protect, understand, and enjoy the natural and cultural resources of Bandelier National Monument through an integrated program where management activities support naturally functioning ecosystems consistent with cultural resource preservation needs.

Bandelier's Fire Management Plan identifies three additional goals:

2. Educate, inform, consult, collaborate, and maintain cooperative fire planning with other land agencies, landowners, and local communities.

3. Achieve ecologically sustainable vegetative conditions across broad vegetation communities by restoring a natural range of variability and bio- diversity. These conditions are described in the fire management plan as Desired Future Conditions (DFC's) and are explained in detail in chapter 2 under "Features Common to All Alternatives."

4. Identify and mitigate hazards related to the WUI through coordination and collaboration with neighboring agencies and landowners over time and across boundaries.

The following fire management objectives support these goals:

1. Protect life, property, and Bandelier's natural and cultural resources from the effects of unwanted fire.
2. Prevent or mitigate impacts due to fire suppression activities.
3. Institute and maintain a comprehensive Fire Information and Education Program.
4. Restore and maintain fire- dependent ecosystems with the appropriate use of fire.
5. Use prescribed fire to meet fire and resource management goals and objectives.
6. Allow natural fires to function in fire dependent ecosystems.

The following fire management strategies may be implemented to maximize the opportunity of achieving the above stated objectives:

Objective 1: Protect life, property, and Bandelier's natural and cultural resources from the effects of unwanted fire.

- Give primary consideration to firefighter, employee, and public safety and provide for the safety of Bandelier's visitors, neighbors, and employees during all phases of fire management operations.
- Conduct all fire management activities commensurate with applicable laws, policies, and regulations.
- Suppress all unwanted fires in Bandelier.
- Cooperate extensively with adjacent land management agencies to facilitate safe and prompt suppression of wildland fires in the interagency mutual aid zone.
- Efficiently use available fiscal resources to suppress wildland fires.
- Use prescribed fire and/or mechanical treatments in Bandelier's developed zones to reduce the risk of property damage due to wildland fire and to provide for human safety and resource protection.
- Create defensible space zones around structures and developed areas in the Monument by using manual and mechanical treatments and/or prescribed fire to clear vegetation and reduce continuity of fuels.
- Implement a cooperative fire prevention program to eliminate unplanned human- caused ignitions.
- Conduct inventories, identify sensitive natural and cultural resources, and develop mitigation plans that provide for the preservation and protection of Bandelier's natural and cultural resources.

Objective #2: Prevent or mitigate impacts due to fire suppression activities.

- Use Minimum Impact Suppression Tactics (see Appendix D for a detailed description) and rehabilitate disturbed areas to protect and mitigate impacts on Bandelier's natural, cultural, wilderness, and scenic resources.
- Ensure that a resource advisor is present and/or consulted on all major fire program activities.
- Inform and train firefighters about the impacts of fire suppression on Bandelier's sensitive natural and cultural resources.
- Avoid the use of non- native seed to rehabilitate sites disturbed by wildland fires or their suppression.

Objective 3: Institute and maintain a comprehensive Fire Information and Education Program.

- Conduct wildland fire prevention, information, education, and other activities in communities within and abutting the Monument, working in collaboration with local communities and county, state, and federal agencies with fire management interests.
- Educate employees and the public about the scope and effect of wildland and prescribed fire management, including fuels management, smoke management, resource protection, fire prevention, hazard/risk assessment, mitigation, rehabilitation, the wildland/urban interface problem, and the role of fire in ecosystem management.
- Emphasize interagency communications for fire management activities, such as job training, sharing of staff, sharing of resources, and evaluation of fire management actions and activities.
- Maintain relationships with the Native American community and encourage their participation in the management of traditional gathering areas. Facilitate the transfer of knowledge about fire management and traditional cultural practices.
- Collaborate with county and state air resource agencies to monitor smoke levels and manage smoke- related effects on visitors, residents, and employees.

Objective 4: Restore and maintain fire- dependent ecosystems with the appropriate use of fire.

- Using the best available scientific data, continue to refine and develop a range of desired future conditions and ecologically sound fire and resource management objectives for Bandelier's vegetation and wildlife communities.
- Include fire and resource management objectives specific to each prescribed fire in the prescribed fire burn plan.
- Use fire to promote the maintenance of native vegetation and discourage non- native vegetation invasions.
- Utilize research and monitoring to improve our understanding of the role of fire in Bandelier's vegetation and wildlife communities. Based on this information, modify actions and strategies to achieve fire and resource management goals and objectives.

Objective 5: Use prescribed fire to meet fire and resource management goals and objectives.

- Where applicable, restore fuel loads and plant community structure and composition to a range of natural variability comparable to pre- anglo settlement (pre 1880) using a predetermined regimen of management- ignited prescribed fires.
- Use management ignited prescribed fires to reduce hazardous fuels and minimize the occurrence of unnaturally intense wildland fires.
- Avoid prescribed fires that would reduce air quality below federal, state, and local regulations.
- Train Bandelier's staff and cooperators to conduct safe, objective- oriented prescribed fires consistent with DO- 18 (NPS, 2003) requirements.
- Ensure that a resource advisor is present or consulted on all prescribed fires.
- Institute and maintain a Fire Ecology Program that, at a minimum, utilizes the National Park Service's Fire Monitoring Handbook (NPS, 2001b) and Fire Effects Assessment Tool to ensure that fire effects are monitored, recorded, and evaluated for all prescribed fires in Bandelier.

Objective 6: Allow natural fires to function in fire dependent ecosystems.

- Allow naturally ignited (lightning) fires to burn in areas where the fuel load and vegetative structure does not promote sustained extreme fire behavior.
- Allow Wildland Fire Use for a Resource Benefit within constraints of policy (NPS, 2003).
- Ensure that a resource advisor is present or consulted on all WFURB's.

RELATIONSHIP OF BANDELIER'S FIRE MANAGEMENT PLAN TO OTHER BANDELIER PLANS

Existing management plans at Bandelier, such as the 1990 Statement for Management (NPS, 1990) and the 1995 Resource Management Plan (NPS, 1995a), provide general guidance for all activities in the Monument. The Resource Management Plan (NPS, 1995a) identifies the need for a fire management program and includes goals and objectives pertaining to the restoration and maintenance of ecosystems and ecosystem processes through the use of fire. It also addresses the topic of fire and cultural resources. The 2002 Draft Vegetation Management Plan (NPS, 2002) for Bandelier establishes broad objectives for the management of vegetation in the Monument. It describes the dynamic environment of the Monument's vegetation, discusses vegetation management issues, and identifies general DFC's for the plant communities in the Monument as well as strategies to achieve these DFC's. One such strategy includes the management of fire regimes. In this way, the Draft Vegetation Management Plan (NPS, 2002) sets the general direction for the Bandelier Fire Management Plan/EA/Assessment of Effect. This is also true for Bandelier's Ecological Restoration Plan/Environmental Impact Statement (EIS). Both the Bandelier Fire Management Plan/EA and the Ecological Restoration Plan/EIS maintain consistency with the 1990 Statement for Management (NPS, 1990), the 1995 Resource Management Plan (NPS, 1995a), and the 2002 Draft Vegetation Management Plan (NPS, 2002) in working toward achieving the Monument's goals, objectives, and desired future vegetative conditions.

PARTIES TO BANDELIER'S FIRE MANAGEMENT PLAN

Bandelier's Fire Management Plan and EA/Assessment of Effect were formulated and completed with the participation of five broad groups of people:

- An Interdisciplinary Team (IDT) composed of NPS and United States Geological Survey staff. This team consists of the following personnel: Superintendent, Fire Management Officer, Assistant Fire Management Officer, Fire Information Officer, Fire Ecologist, Chief of Resources, Outdoor Recreation Planner, Archeologists, Wildlife Biologist, Vegetation Specialist, United States Geological Survey Research Scientist, Protection Ranger, and Chief of Maintenance.
- Internal reviewers. This includes expertise from the NPS Intermountain Region and Santa Fe Support Office.
- Other consulting agencies, including the United States Department of Agriculture Forest Service, New Mexico State Historic Preservation Office, and the United States Fish and Wildlife Service.
- Local Native American Pueblo Governments.
- The public. Three public scoping meetings were held in Los Alamos, Santa Fe, and Albuquerque in 2003.

IMPACT TOPICS SELECTED FOR DETAILED ANALYSIS

Impact topics and issues associated with the development and implementation of Bandelier's Fire Management Plan were identified and refined through internal and external scoping sessions (Table 1.4). An "impact topic" is the general subject matter or area that has the potential to be impacted by proposed actions. An "issue" describes the specific environmental problem or effect as well as the relationship between the resources and the proposed actions. The parties involved in the scoping sessions selected twelve impact topics for detailed analysis in this EA. The impact topics are listed below. Each topic is further discussed in Chapter 3: Affected Environment and is analyzed in detail in Chapter 4: Environmental Consequences.

Table 1.4 Impact topics and issues related to the development and implementation of Bandelier's Fire Management Plan (derived from internal and external scoping sessions during 2003).

Impact Topic	Issues
Biological Resources	
Vegetation	
	• Fire can alter vegetation structure and composition • Fire affects plant productivity and vigor • Fire can initiate or end vegetation successional pathways • Lack of fire can contribute to insect infestations and disease • Fires can be stand- replacing and stand- destroying • Fire is a thinning agent • Fire reduces fuel loading • Frequent fire reduces risk of catastrophic fire • Root systems of large trees can be affected if fire residence time is long • Aspen clones are fire- dependent • Montane meadows and grasslands are fire maintained • Riparian vegetation can be affected by changes in stream characteristics due to post fire run- off
Invasive non- native species	• Fire can increase or decrease invasive non- native plants
Threatened, endangered, and special status species - plants	• Fire can positively or negatively affect threatened, endangered, or special status species
Species of concern at Bandelier - plants	• Old- growth trees, individuals and stands, can be positively or negatively affected by fire • The grape fern and gramma grass cactus can be affected by fire actions and activities

Impact Topic	Issues
Wildlife	• Fire can cause edge effects • Mortality or injury to individuals can occur • Habitat degradation or improvement can occur • Cavity- and ground- nesting birds may be negatively affected in the short- term but long- term effects may be beneficial • Fire and smoke can disrupt cave use (bats)
Threatened, endangered, and special status species - wildlife	• Fire can positively or negatively affect threatened, endangered, or special status species
Physical Environment	
Soils and Water Resources	• Soil disturbance due to fire operations (fire lines, base camps, etc.) can occur • Erosion can occur • Fire can alter physical, chemical, and biological soil properties • Microbial communities can be affected (both positive and negative) • Hydrophobic soils can be created by high intensity fire • Soil water holding capacity may decrease immediately post- fire • Fire can release nutrients bound in forest organic matter • Mud flows can occur • Rock slides can occur • Increased run- off may result in sedimentation and nutrient loading in streams • Water quality can be degraded below federal, state, and local regulations • Aerial fire retardant may pollute water sources • Fire can increase risk of flash flooding • Stream beds may be altered due to flooding events

Impact Topic	Issues
Air Quality	• Emissions can degrade air quality below federal, state, or local regulations • Smoke and particulates can impact visibility and health • Prescribed fire allows for some control over smoke dispersal and particulate levels
Cultural Resources	
Archeological Resources	• Toppling of standing masonry by fire crews conducting the treatment • Toppling of standing masonry by falling trees • Dozer blades and tracks can cause severe damage in and around sites by cutting deep into soils and displacing cultural materials • Ground disturbance, such as handline and helispot construction and the dragging of slash can result in exposure of subsurface debris and cultural materials. • Structural sites can be affected if vegetation and other materials are inadvertently piled on the site, increasing the flammability • High intensity fire can cause heat alteration of artifacts. Melting, charring, spalling, and complete incineration can occur • Fire can result in sub surface heating that can damage sites • Activities associated with fire rehabilitation such as water bar construction and installation, berm leveling, equipment used for re- seeding, planting, salvage logging, and fuelwood collection could damage sites and materials • Unauthorized collection of artifacts by crews • Fire can expose previously unknown or inaccessible cultural sites and materials to theft or vandalism • Fuel reduction can help protect cultural resources from wildland fire
Ethnographic Resources	• Fire can enhance and maintain or negatively affect native plant collection areas

Impact Topic	Issues
Cultural Landscapes Resources	• Accumulation of fuels on structural portions of sites can increase the fire damage if the site should burn • Fire can maintain and restore cultural landscapes
Historic Resources	• Accumulation of fuels on structural portions of sites can increase the fire damage if the site should burn • High intensity fire can cause heat alteration of artifacts. Melting, charring, spalling, and complete incineration can occur • Exposed walls can be damaged by retardant drops from air tankers
Social Resources	
Public Health and Safety	• Fire lines may be confused for trails • Visitors may be exposed to smoke and particulates • Visibility on roads may be impaired • Potential for fire to spread to private property • Opportunity to promote fire- wise housing • Opportunity to work with neighboring land agencies and owners • Increased public safety from fuel reduction efforts
Visitor Use and Experience	• Fire may cause traffic congestion • Fires may prevent visitors from enjoying all parts of the Monument • Campsites, trails, picnic areas, and backcountry areas may be closed due to fire • Fire can create more forest openings, providing more wildlife viewing for visitors • Fire related activities and equipment (chainsaws, helicopters) can increase the level of sound, affecting visitor experience • Fire may attract or detract visitors • Increased opportunity to educate the public about fire
Wilderness	• Fire and fire- related activities can have negative or positive effects on wilderness values

The topics listed in Table 1.4 are summarized below. These topics form the basis of the impact analysis presented in Chapter 4: Environmental Consequences.

1. Vegetation
2. Wildlife
3. Special Status Species (plants and wildlife)
4. Soils and Water Resources
5. Air Quality
6. Archeological Resources
7. Ethnographic Resources
8. Cultural Landscape Resources
9. Historic Resources
10. Public Health and Safety
11. Visitor Use and Experience
12. Special Designations: Wilderness

IMPACT TOPICS DISMISSED FROM DETAILED ANALYSIS

Several issues and impact topics were considered during internal and external scoping, but were eliminated from further analysis in this EA. Some of the issues identified were incorporated into other issues (e.g., "Recreation and Tourism" was incorporated into "Visitor Use & Experience"). The following issues were eliminated for the reasons provided below:

Table 1.5. Topics considered in internal and external scoping, but dismissed from detailed analysis

Topic	Reason for Dismissal
Geology	No substantial issues pertaining to the Monument's geology were identified to warrant a detailed analysis of this topic.
Soundscapes	Implementation of the FMP may cause some short- term noise disturbance from motorized equipment and other activities. However, these effects are anticipated to be short- term and negligible, and do not warrant a detailed analysis.
Park operations	There were no substantial issues identified in relation to park operations. Any effects, such as Monument staff being diverted to fire operations, would be insignificant or short- term and negligible.
Socioeconomics Socioeconomics	The socioeconomic environment includes local and regional businesses and residents, the local and regional economy, and concessions at the Monument.

	The economies of the surrounding communities of Los Alamos and White Rock function independently of Bandelier tourism, even though Monument visitors do take advantage of local lodging and restaurants. Although some possible issues were identified in relation to socioeconomics, the implementation of the fire management plan is expected to have negligible effects on the local and regional economy and Monument concessioners. For these reasons, the socioeconomic environment has been dismissed as an impact topic.
Sustainability and long- term management	Aspects of this topic are covered under several others that address long- term management objectives and impacts in relation to fire management activities that would occur under each alternative.

In addition to the above dismissed topics, the following topics that are specified in NPS Director's Order #12 (DO- 12) and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision Making (NPS, 2001c), were not included in the analysis for the reasons provided below:

Table 1.6 Topics specified in NPS DO- 12, but dismissed from detailed analysis.

Topic	Reason for Dismissal
Wetlands and Floodplains	No fire management actions or activities are proposed within identified wetland and floodplain areas. Indirect effects of fire disturbance are considered under water resources. Therefore, this has been dismissed as an impact topic.
Wild and Scenic Rivers or Ecologically Critical Areas	No designated Wild and Scenic Rivers or other ecologically critical areas are known in or near Bandelier.
Prime and Unique Agricultural Lands	No prime or unique agricultural farmlands exist within Bandelier National Monument, and none would be affected by actions proposed in any of the alternatives. Therefore, this topic has been dismissed from further analysis.
Indian Trust Resources	Federal agencies are required to address environmental impacts of their proposed actions on Indian Trust Resources in any environmental document (Secretarial Order 3175 and ECM95- 2). There are no identified Indian Trust Resources within Bandelier. Therefore, this topic has been dismissed from further analysis.
Conflicts with Existing Land Use Plans, Policies, or Controls for the Area	No conflicts have been identified between the proposed FMP and any existing plans, policies, or controls for the area.
Energy Requirements	None of the alternatives would affect energy or depletable resource

/Depletable Resource Requirements and Conservation Potential	requirements or conservation potential to the extent that detailed analysis would be required.
Environmental Justice	Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low- income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing if their programs and policies have disproportionate effects on minorities and low- income populations and communities. No minorities or low- income populations or communities, as defined in the Environmental Protection Agency's guidelines for environmental justice concerns, would be disproportionately affected; therefore, environmental justice has been dismissed as an impact topic.

Chapter 2
ALTERNATIVES

INTRODUCTION

The fire management plan alternatives presented in this EA are a range of scenarios, developed by internal and external scoping, that describe various reasonable strategies of accomplishing Bandelier's fire and resource management goals and objectives (see "Bandelier's Fire and Resource Management Goals and Objectives" in Chapter 1: Purpose and Need for Action). The alternatives were created with the consideration of NPS policies, the Monument's fire history, fire literature, ecological principles, past and present successes and challenges, safety concerns, public input, and economic and logistical criteria.

The alternatives considered for detailed analysis must be consistent with the Monument's purpose as well as the fire and resource management goals and objectives identified in Chapter 1. They must also satisfy the project's purpose and need for action. The alternatives that meet these criteria are described below and are analyzed in detail in Chapter 4: Environmental Consequences. The alternatives that do not meet these criteria have been eliminated from further analysis. A description and the reasons for their dismissal are explained below in the section titled "Alternatives Eliminated from Detailed Analysis."

DEVELOPMENT OF ALTERNATIVES

The fire management plan alternatives considered in this document were developed from comments and concerns expressed by the IDT and the public; input from federal, state, and local agencies; guidance from existing park plans; policy guidance from the NPS, the National Fire Plan, 2001 Federal Fire Policy, and research, monitoring, and experience from the existing fire and resource management programs.

STRATEGIES USED TO MAINTAIN AND RESTORE ECOSYSTEMS

Fire Suppression

Suppression involves extinguishing a wildland fire that is burning outside of prescription parameters (e.g. rate of spread is too high), is not meeting fire and resource objectives, is in a location designated as a suppression zone, or may pose an immediate threat to life or property. All non- planned human caused fires will be suppressed. Each alternative allows for fire suppression. Tactics for suppression are varied and depend on the particular situation (e.g. location, weather, safety considerations, etc.) for each individual fire. Suppression actions can include hand crews cutting a line around the fire perimeter to remove live and dead vegetation; water and retardant drops from aircraft; manual and mechanical thinning; "burn out" situations in which fire is used to remove live and dead vegetation in an effort to stop the fire; and "cold trailing" in areas of low fuel loads, where crews physically feel the ground and put out "hot spots."

In areas with sensitive natural or cultural resources, Minimum Impact Suppression Tactics (see Appendix D) are used and/or resource advisors are consulted.

Wildland Fire Use for a Resource Benefit (WFURB)

Wildland Fire Use for a Resource Benefit is the practice of allowing a naturally ignited wildland fire to burn in a predefined geographic area, under specific prescription parameters, to accomplish fire and resource management goals and objectives. The safety of firefighters and the public is the number one concern in managing a WFURB. Through pre- planning, fire monitoring, and appropriate management response, many wildland fires can be managed to protect values at risk as well as to obtain resource benefits. Elements of managing a WFURB include public information and education, fire behavior and fire effects monitoring, and coordination with other agencies.

Note: Values at risk are defined in this document as an assessment of resources, such as property, structures, natural and cultural resources, and economic, political, environmental, and social values, which may be affected by an incident now and in the foreseeable future.

Prescribed Fire

Prescribed fires are intentionally lit under predetermined conditions to meet fire and resource management goals and objectives. Prescribed fires include pile burning, where vegetation is cut and moved to a central location and burned, or broadcast burning, where fires are ignited within a predefined area and allowed to move through the vegetation within those boundaries. All environmental compliance must be met prior to any fire ignition and a written and approved prescribed fire plan must exist. Within the prescribed fire plan are detailed prescription parameters that must be followed. For example, in Bandelier's low elevation ponderosa pine forests, a burn prescription might require that the mid- flame windspeed be less than 10 mph, average flame lengths must range from 1 inch to 8 feet, and average rate of fire spread must be less than 30 ch/hr (1 chain=66 feet.). If these parameters are not met, the fire is considered out of prescription and would be suppressed.

Prescribed fire has been used at Bandelier since 1976 to meet a variety of fire and resource management goals and objectives. Meadows have been burned to remove tree encroachment and promote the growth of grasses and forbs. Forested areas have been burned to reduce fuels and create gaps in the canopy to promote growth of understory species. Woodlands have been burned to reduce stem density of pinyon and juniper and increase grass and herbaceous production. Prescribed fire has also been used to replicate historic fire frequencies in Bandelier's lower elevation ponderosa pine forests.

Prescribed fire can also be used to reduce heavy accumulations of live and dead vegetation (fuels). Once these areas are treated, the continuity of fuels is reduced, helping to prevent rapid, intense, and uncontrolled fires that could damage natural or cultural resources or threaten life and property.

Non- fire Fuel Treatments

Non- fire fuel treatments include manual and mechanical thinning. In general, thinning involves removing live and dead vegetation (fuels) according to a prescribed plan to meet specific objectives related to hazardous fuels management. Thinning is also used as a pre-treatment for prescribed burning to remove smaller diameter trees, ladder fuels, shrubs, snags, and ground litter to help keep the fire within the designated area or to protect specific resources. When multiple burns are needed to reduce hazardous levels of fuels, thinning pre- treatments can expedite the process by several years. Thinning is also used in suppression actions and as an effective treatment to reduce fuels in the WUI.

Adaptive Management

Adaptive management is generally considered to be the process of continually adjusting management strategies in response to new information, knowledge, or technologies. The City of Boulder (Colorado) Forest Ecosystem Management Plan (1999) states the following comprehensive definition of adaptive management: "A process for implementing management decisions that requires monitoring of management actions and adjustment of decisions based on past and present knowledge. Adaptive management applies scientific principles and methods to improve management decisions incrementally as experience is gained and in response to new scientific findings and societal changes."

The adaptive management cycle begins with developing a plan that articulates the project's goals, objectives, and strategies. The plan is then implemented and the actions and responses are monitored. The results of this monitoring are evaluated to determine if the actions were appropriate and achieved the stated goals and objectives, or if a change in action or method is necessary to meet objectives.

Adaptive management at Bandelier will be used to guide fire management activities. The first step in this process is to draw on the best available science, monitoring, and emergent technologies to develop a fire management plan that articulates Bandelier's fire and resource management goals, objectives, and strategies. The implementation stage will be completed over time and all actions and responses will be monitored by Bandelier's Fire and Resource Management Staff. The results of this monitoring will be used to determine whether the actions had the desired effects, whether more information is needed, and whether the actions or prescriptions need to be modified to meet the Monument's goals and objectives. If the adaptive management process identifies other actions not covered under this EA, a new NEPA document will be prepared before project implementation.

Fire Ecology Program

In order to use prescribed fire on National Park Service lands, Reference Manual (RM)- 18 (NPS, 2003) mandates that a Fire Effects Monitoring / Fire Ecology Program be in place. This vegetation monitoring program uses the best available information (such as data collected on- site, scientific journals, and knowledge from resource specialists) to formulate realistic objectives for desired future resource conditions. Involving the Monument staff at many levels, as well as local scientists from universities or cooperating/neighboring agencies, is important to this process. Once desired future resource conditions are agreed upon, specific and measurable objectives are written, a desired degree of certainty in the results is determined, and vegetation sampling protocols are established and implemented. After the data has been collected, it is used to evaluate if fire and resource management objectives are being met and to determine if additional research is needed. If unexpected trends are identified, objectives may need to be revised and/or the program re- evaluated. When this information is used to re- evaluate program goals or objectives, the adaptive management process comes full- circle.

The over- riding goals and objectives of Bandelier's Fire Ecology Program are to:

1. Use an adaptive management approach to work with resource and fire managers to identify resource management challenges, desired future conditions, and monitoring objectives for vegetation types to be treated with prescribed fire.
2. Record basic fire behavior and weather information for all prescribed fires.
3. Establish and implement a sampling design and data collection protocol for each vegetation community to be treated with prescribed fire.
4. Document and analyze short and long- term fire effects on vegetation.
5. Use all available information to determine if fire and resource management objectives are being met.
6. Identify where or if additional fire effects research is needed.

Fire Monitoring

Monitoring of all fires, including suppression fires, WFURB, and prescribed fires, involves the systematic collection and recording of data on fuels, topography, weather, air quality, and fire behavior. At a minimum, monitoring at Bandelier follows the protocols outlined in the National Park Service Fire Monitoring Handbook (NPS, 2001c). This information is broadcast over radios to all fire personnel during the fire event and then later provided to fire managers in a report. All prescribed fire monitors are trained and certified in both basic fire behavior and prescribed fire monitoring techniques.

FEATURES COMMON TO ALL ALTERNATIVES

Regardless of which alternative is implemented, all of the following actions will be included in the Bandelier Fire Management Plan.

Features Common to All Alternatives: Public and Firefighter Safety

Public and firefighter safety is the number one priority of all alternatives. The 2001 Federal Fire Policy states: "Firefighter and public safety is the first priority, and all fire management plans and activities must reflect this commitment." National Park Service Wildland Fire Policy (DO- 18) reinforces this direction: "The National Park Service is committed to protecting park resources and natural ecological processes, but firefighter and public safety must be the first priority in all fire management activities." The Bandelier Fire Management Plan will enact the following to ensure the safety of firefighters and the public:

- Every firefighter and fire line supervisor, the fire program manager, and the Superintendent will take positive actions to ensure compliance with safe fire management practices.
- Experience, training, physical fitness, and knowledge of safety practices is required of all personnel in fire operations.
- All wildland fire safety standards [including the 10 Fire Orders, 18 Watchout Situations, Downhill/Indirect Line Checklist, Four Common Denominators of Fatality Fires, Lookouts- Communications- Escape Routes- Safety Zones (LCES), and Risk Management/Situational Awareness] are required annual training for all personnel involved in wildland fire operations. (These safety standards can be found at: http://www.nwcg.gov/pms/pubs/large.html#FirelineHandbook).
- Mandatory annual hands- on fire shelter deployment training.
- The safety training requirements listed in Chapter 3 of National Park Service RM-18 are adopted and followed.
- Qualification standards for Incident Command System positions as listed in National Wildfire Coordinating Group 310- 1 "Wildland Fire Qualification Subsystem Guide" are adopted.
- All project plans address safety concerns in an attached job hazard analysis.
- A safety briefing is given prior to initiating work on any project.
- Every project or incident will have at least one person charged with incident safety oversight; complex situations require multiple safety officers.
- All personnel are authorized and obligated to exercise emergency authority to stop and prevent unsafe acts.

- All employees have the right to turn down unsafe assignments and have the responsibility to identify safe alternatives to accomplish the mission.
- After Action Reviews will be conducted by the project leader or incident commander after each shift of a project or incident to evaluate safety and effectiveness of work performed and identify and discuss encountered hazards.
- All wildland fire incidents that result in human entrapment, fatalities, or serious injuries, or that have the potential to result in such, are reported and investigated as required by RM- 18, Chapter 3.
- The Superintendent (or designee) manages critical incidents following checklists and processes contained in the National Wildfire Coordinating Group's "Agency Administrator Guide to Critical Incident Management."
- All personnel on wildland fires are equipped with proper personal protective equipment (PPE) as described in Chapter 3 of RM- 18. All personnel carry a fire shelter on wildland fires at all times unless in a designated safety zone.
- All personnel on projects or fire management activities adhere to special PPE requirements specific to those operations (e.g., power saws, helicopters).
- Other personnel (such as fire ecologists, resource specialists, etc.) to wildland fires are equipped with Nomex clothing, gloves, hardhat, and fire shelter, and are accompanied by an operationally qualified person that can maintain communications with the incident management team and recognize potential problem fire behavior.
- All vehicles and drivers engaged in fire management activities meet Government Services Administration and agency standards, as well as state licensing requirements.
- All personnel engaged in wildland fire activities adhere to the health screening/medical surveillance and fitness requirements of RM- 18, Chapter 3.
- All arduous duty fire management personnel are provided five hours per week of duty time to achieve and maintain physical fitness levels as prescribed in RM- 18, Chapter 3.
- Radios are assigned to all fire crews and monitors when working on wildland fires. Special permission must be obtained from the incident manager for individuals to work alone on actively burning fires.
- Perimeter control is assigned on all fire management projects and incidents to prevent non- fire personnel from entering the project/incident area without escort or proper PPE. The intent of perimeter control is to prevent injury to non- fire personnel from unmitigated hazards of smoke, heat, falling debris, and machinery.
- Trails and roads providing access to mechanical fuel reduction projects, managed wildland fires, unwanted wildland fires, or prescribed fires are closed if such fires and/or projects present unacceptably hazardous conditions to the public. Roads and trails remain closed until conditions improve.

- Smoke warning signs on roadways and/or traffic control are instituted during wildland fires as conditions warrant and at the direction of the Burn Boss, Incident Commander, Safety Officer, or a visitor protection representative.
- The Superintendent may close portions of the Monument or the entire Monument due to any threat to the public or firefighter safety from wildland fire or fire management activities. If such an action occurs, adjacent agencies and authorities are notified as soon as possible.

Features Common to All Alternatives: Public Information and Education

The Fire Management Public Information and Education Program will expand ongoing efforts to educate employees and the public about the scope and effect of wildland fire management, including fuels management, resource protection, prevention, hazard/risk assessment, mitigation and rehabilitation, and fire's role in ecosystem management. The Public Information and Education Program will increase public awareness and support of the fire management program by communicating the program's goals and objectives and utilizing national fire communication strategies.

The Public Information and Education Program goals are:

- To provide year- round education on fire management and fire ecology.
- To work within and promote the interagency relationship established with agencies adjacent to Bandelier including the Santa Fe National Forest, Department of Energy/Los Alamos National Laboratory, Los Alamos County Fire Department, and all partners within the Santa Fe Zone.
- To work within and promote the relationships established with community groups, environmental groups, and other interested non- governmental partners.
- To provide accurate and timely incident information for local, regional, and national fire operations as needed.
- To provide local communities, Monument employees and families, and Monument visitors with information on fire safety, fire prevention, defensible space, and fuels management.

An important reference for fire information work is being developed in conjunction with Santa Fe Zone partners. Specific operational procedures (checklists, media contacts, web update information, etc.) are outlined within this document.

Communication Methods

The Public Information and Education Program interfaces and communicates with the public through personnel and multi- media services. Both are described in detail below.

Personnel Services:

Interpretive Programs – Bandelier's Fire Education, Prevention, and Information Specialist will integrate fire messages into hikes, tours, displays, site bulletins, and campfire programs.

Employee Training – Bandelier will annually coordinate new and seasonal employee training sessions to improve staff understanding of the fire and fuels management program.

Education Programs – Bandelier will develop programs and incorporate fire ecology concepts into curriculum- based education programs, summer day camp programs, and teacher workshops.

Roving – When fire operations occur within or close to Bandelier, employees (including temporary hires, interns) and interagency partners will be stationed when possible at strategic locations to answer questions about the current fire activity and explain the fire management program.

Special Events – Bandelier will participate in local events to promote the fire management program and fuels management practices.

Public Meetings - The Monument may conduct special public meetings related to specific fire events, planning efforts, fuels projects, or any other matter where dissemination of information is needed or desired.

Multi- media Services:

Web Information – Bandelier's Fire Education, Prevention, and Information Specialist will provide necessary information to the webmaster of the NPS fire site in Boise, ID and will provide material for the Bandelier web site.

Media Stories – Bandelier will communicate with print, radio, and television outlets through press releases and interviews.

Printed Handouts – Bandelier will include fire information in regular Monument publications, such as the Monument newspaper.

Visitor Center Exhibits, Waysides, and Bulletin Boards – Bandelier will provide interpretive information in visitor centers and wayside exhibits.

Evaluation

Bandelier's Fire Education, Prevention, and Information Specialist will prepare an annual report on the Public Information and Education Program that documents the accomplishments for the year. This report will be presented to the Monument administrators, the regional Fire Management Office in Denver, Colorado and to the national communications program in Boise, Idaho.

Features Common to All Alternatives: Appropriate Management Response

Each fire start will be evaluated against the fire management plan to determine the appropriate action. Actions that could be considered include fire suppression using direct fireline, fire suppression using natural containment boundaries, or allowing the fire to burn to meet pre- stated fire and resource management objectives (WFURB). All non- planned human caused fires will be suppressed.

Features Common to All Alternatives: Fire Suppression

Suppression involves extinguishing a wildland fire that is burning outside of prescription parameters (e.g. rate of spread is too high), is not meeting fire and resource objectives, is in a location designated as a suppression zone, or is a threat to life or property. All non-planned human caused fires will be suppressed. Each alternative allows for fire suppression. Tactics for suppression vary and depend on the particular situation (e.g. location, weather, safety considerations, etc.) for each individual fire. Suppression actions can include hand crews cutting a line around the fire perimeter to remove fuel, water and retardant drops from aircraft, manual and mechanical thinning, "burn out" situations in which fire is used to remove vegetation and fuels in an effort to stop the fire, and "cold trailing" in areas of low fuel loads, where crews physically feel the ground and put out "hot spots."

In areas with sensitive natural or cultural resources, firefighters will refer to the Minimum Impact Suppression Tactics guide (see Appendix D) and consult with a resource advisor.

Features Common to All Alternatives: Treatment Areas in the WUI

The WUI is the line, area, or zone where structures and other human development meet or intermingle with undeveloped land or naturally occurring flammable fuels. Treatment areas in the WUI are locations where activities such as manual thinning, mechanical thinning, and prescribed burning are implemented to create defensible space used to reduce the risk of catastrophic fire and to assist in defending developed areas. Treatment areas range from 0- 600 ft. wide, depending on resource conditions, such as fuel load,

continuity of fuels, and topography. Width of treatment areas will be evaluated through the adaptive management process.

Features Common to All Alternatives: Fire Regime and Condition Class

The Fire Regime and Fire Regime Condition Class (FRCC) classification described below will be used in the fire management planning process at Bandelier.

Fire regime is a term used to describe attributes, such as the frequency, intensity, extent, and duration, of a naturally occurring fire as it would typically burn in a particular vegetation community or landscape. This term is generally used to describe the role of fire as it occurred historically, before widespread suppression or interruption of natural fires. These historic fire regimes have been defined (on a course scale) by Hardy et al. (2001) and Schmidt et al. (2002) and are listed in Table 2.1 below:

Table 2.1 Historical fire regimes

Fire Regime	Description
1	0- 35 year frequency and low to mixed severity, surface fires most common, less than 75% of the dominant overstory vegetation replaced.
2	0- 35 year frequency and high severity, stand replacing fires, greater than 75% of the dominant overstory vegetation replaced.
3	35- 100+ year frequency and mixed severity, less than 75% of the dominant overstory vegetation replaced.
4	35- 100+ year frequency and high severity, stand replacing fires, greater than 75% of the dominant overstory vegetation replaced.
5	200+ year frequency and high severity, stand replacing fires.

One aspect of the fire regime that is of particular interest is fire frequency, which can vary greatly depending on the vegetation community. The frequency of naturally occurring fire in a specific vegetation community is typically expressed as an average range, called the *fire return interval*. When these naturally occurring fires are regularly suppressed, the *fire return interval*, and therefore the natural *fire regime*, is disrupted. One way of describing or quantifying this disruption is by the *fire return interval departure,* defined as the number of *fire return intervals* that would have occurred naturally if fires had not been suppressed. A high departure from the natural fire regime indicates that the ecological integrity of the vegetation community or landscape may be compromised. Hardy et al. (2001) and Schmidt et al. (2002) developed a classification system that can be used to describe the amount of departure from the natural fire regime. This classification is called the FRCC and includes three condition classes for each fire regime. Table 2.2 below gives a simplified description of the FRCC and the associated potential risks:

Table 2.2 Fire regime condition classes.

Fire Regime Condition Class	Description	Potential Risks
1	The area is generally within the natural range of variability for vegetation characteristics, fuel composition, fire frequency, severity, and pattern, and other associated disturbances.	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion. The composition and structure of vegetation and fuels are similar to the natural regime. The risk of losing key ecosystem components (e.g. native species, large trees, and soil) is low.
2	The area is moderately departed from the natural range of variability for vegetation characteristics, fuel composition, fire frequency, severity, and pattern, and other associated disturbances.	Fire behavior, effects, and other associated disturbances are moderately departed. The composition and structure of vegetation and fuels are moderately altered. The risk of losing key ecosystem components (e.g. native species, large trees, and soil) is moderate.
3	The area is highly departed from the natural range of variability for vegetation characteristics, fuel composition, fire frequency, severity, and pattern, and other associated disturbances.	Fire behavior, effects, and other associated disturbances are highly departed. The composition and structure of vegetation and fuels are highly altered. The risk of losing key ecosystem components (e.g. native species, large trees, and soil) is high.

Features Common to All Alternatives: Fire Management Units

For the purposes of guiding the management of fire, Bandelier recognizes four possible fire situation designations ("units") that could be applied to all geographic areas in the Monument. These designations were created in collaboration with other land agencies and interested organizations including the Bureau of Land Management, the United States Forest Service, Bureau of Indian Affairs, state agencies, and county and city governments who have jurisdiction on lands adjacent to the Monument. Units were created to ensure that management of wildland fires and fuels would be well coordinated among the various agencies that manage public lands in and surrounding the Monument.
The designations, or units, identify which fire management activities and strategies (as detailed in the Fire Management Plan) can be applied to specific areas in the Monument. The characteristics and objectives of each unit are listed in Table 2.3 below.

Table 2.3 Characteristics and objectives of each fire management unit.

Unit Number	Characteristics	Objectives
I	In unit 1, wildland fire is typically not desired.	Provide highest level of fire protection in this unit.
	Areas generally have a high fuel hazard with fire regimes 1, 2, or 3, and condition class of 3; and/or wildland fires would threaten life or property such as in residential areas and in other areas with high- value natural, cultural, or structural resources such as watersheds, developed recreation sites, private lands, and areas where there is little or no social tolerance for wildland fire.	Emphasize full fire suppression response over other responses to wildland fires.
2	In unit 2, wildland fire is typically not desired but there could be exceptions when the fire environment (fuel, weather, topography) is conducive to WFURB.	Provide high level of fire protection.
	Areas are generally in close enough proximity that fire could carry into a unit 1 area and/or have a high fuel hazard with fire regimes 1,2, or 3 and condition class 3, but the natural, cultural, or structural values are not as high as in unit 1. Also areas where there is a low social tolerance for wildland fire, although tolerance for fires is higher than in unit 1.	Emphasize suppression other than full control responses (contain, control, confine).
3	In unit 3, wildland fire is typically desired but there are exceptions when the fire environment (weather, fuel, topography) would lead to unacceptable impacts, or fire is socially unacceptable.	Allow fire to serve its natural role in the ecosystem
	Areas are generally outside the WUI, communities at risk, municipal watersheds, and other areas containing high- value natural, cultural, or structural resources.	Emphasize WFURB as the primary strategy except where environmental or social conditions dictate otherwise.
4	There is at least a moderate level of social tolerance for wildland fires. In unit 4, wildland fire is desired.	Allow fire to serve its natural role in the ecosystem.
	Areas are generally located away from WUIs, communities at risk, municipal watersheds and other areas containing high- value natural, cultural, or structural resources, such as within the interior of designated wilderness or other largely unroaded and undeveloped areas, and/or where there is a high level of social tolerance of wildland fires.	Emphasize WFURB as the primary strategy.

At present, Bandelier is divided into two areas, Unit 1: fire suppression, and Unit 3: WFURB unit (Figure 2.1).

Unit 1: fire suppression unit. All natural ignitions within the boundaries of Unit 1 are declared unwanted wildland fires and are suppressed. However, prescribed fires in this unit are utilized for the purposes of hazard fuel reduction and natural and cultural resource management.

This unit consists of three geographic areas within the Monument:

1. The visitor center, headquarters, and the mesa- top developed area. This also includes trailheads in and around Frijoles Canyon Headquarters area. These features, along with attendant utilities, large cultural sites, and other values are at risk for potential damage or destruction resulting from wildland fire.
2. Apache Mesa, west of the Upper Frijoles Crossing trail and the entire Upper Frijoles watershed.
3. The detached Tsankawi unit.

Figure 2.1 Fire Management Units in Bandelier National Monument

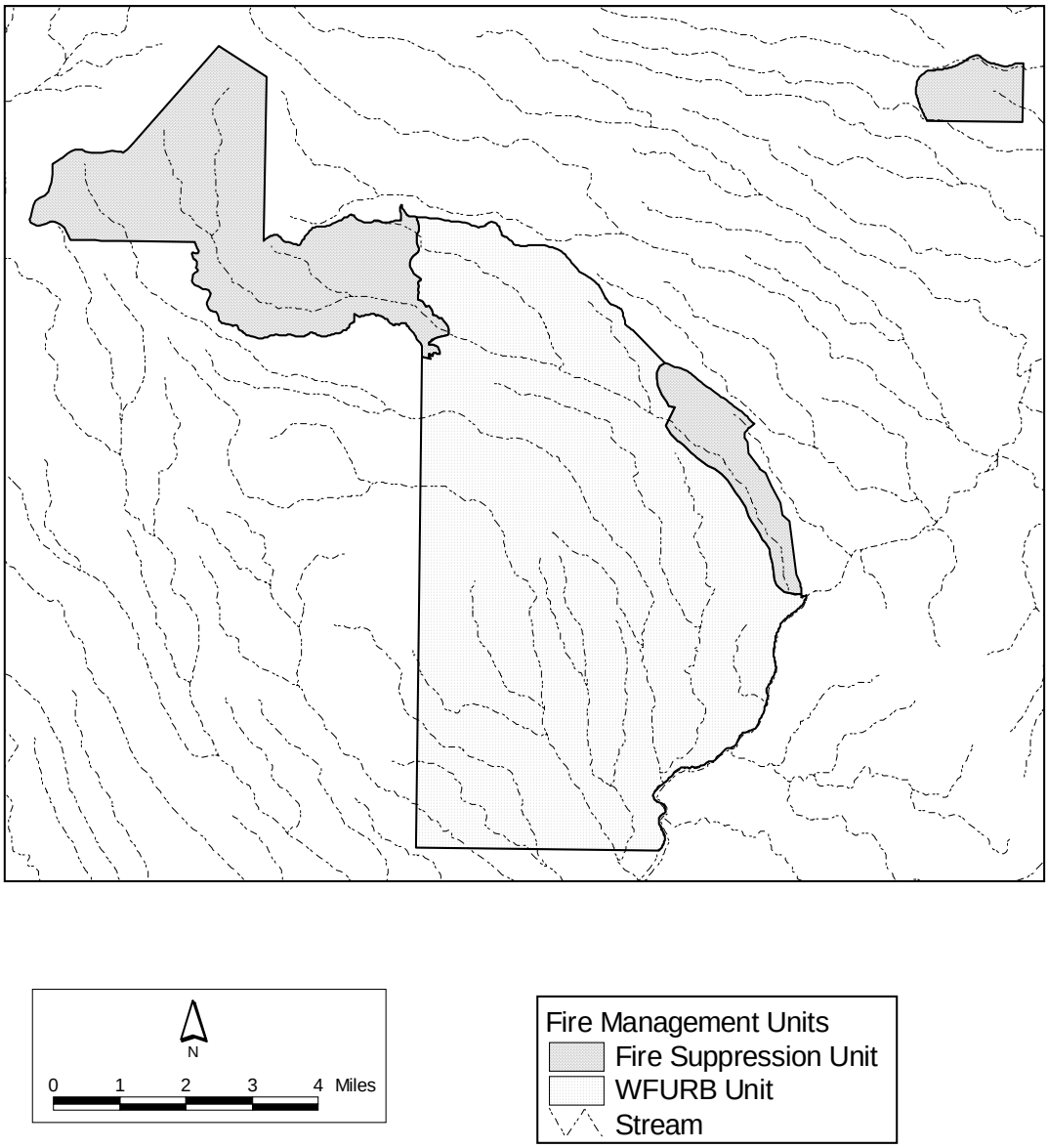
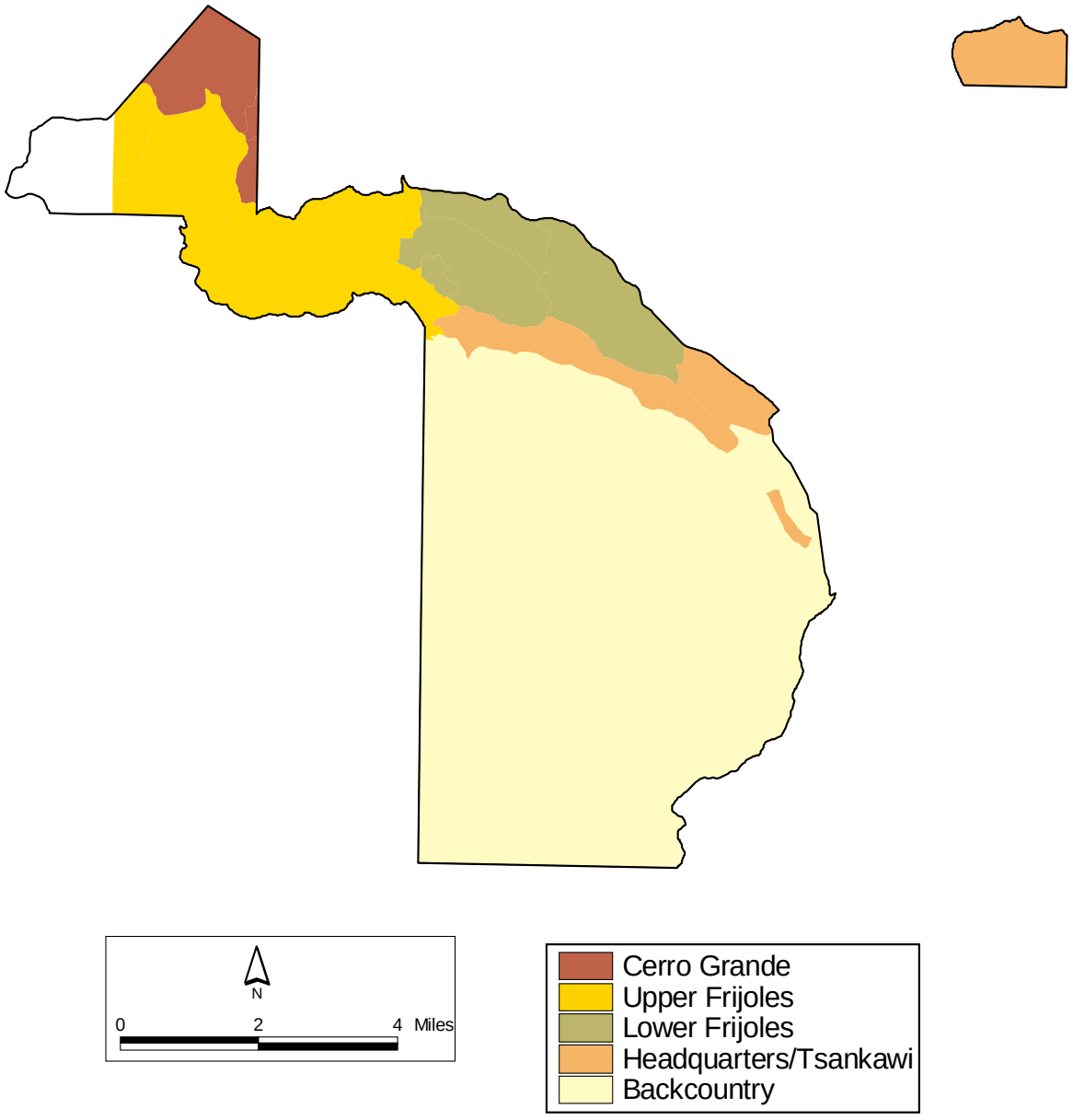
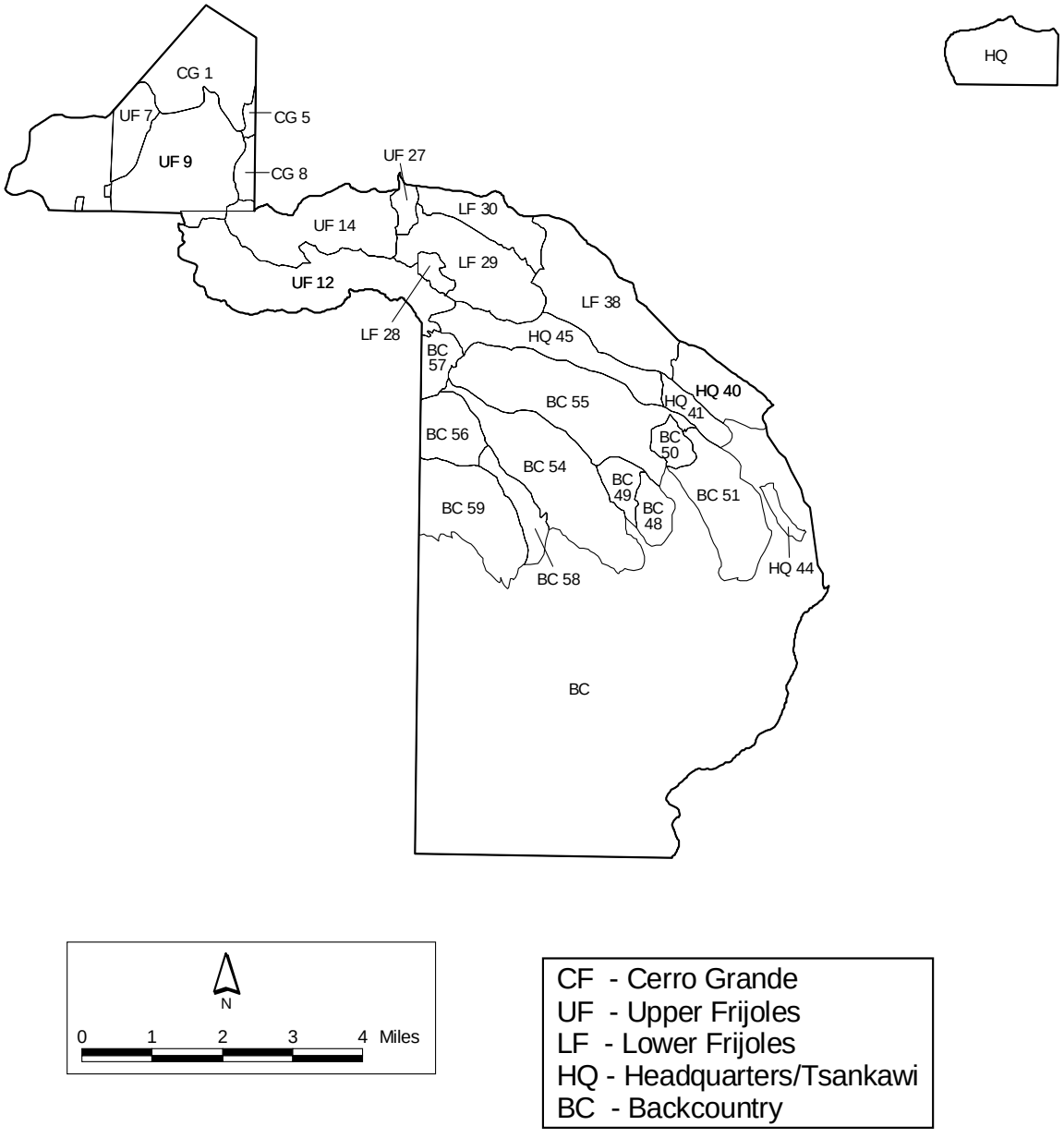


Figure 2.2 Fire Management Treatment Units in Bandelier National Monument



10/27/04 K.Beeley, Bandelier National Monument

Figure 2.3 Fire Management Project Areas in Bandelier National Monument



9/27/04 K.Beeley, Bandelier National Monument

Unit 3: Wildland Fire Use for a Resource Benefit unit. All natural ignitions which meet prescription parameters as well as fire and resource management goals and objectives are allowed to burn in this unit.

This unit comprises all of the remaining Monument lands. It lies south of State Route 4 between the Ponderosa Pine Campground and approximately one mile west of the Bandelier entrance station. In addition, the mesas between Frijoles and Alamo canyons and all the land south of Alamo Canyon to the Monument boundary is included in this unit.

Features Common to All Alternatives: Treatment Units and Project Areas

For the purposes of fire management planning, the Monument is divided into five treatment units: "CG" Cerro Grande, "UF" Upper Frijoles, "LF" Lower Frijoles, "HQ" Headquarters, and "BC" Backcountry (Figure 2.2). Each of these areas consists of numbered project areas. Twenty- seven project areas are identified and comprise approximately 35% of the total Monument area (Figure 2.3). The boundaries of these project areas are in most cases fuel breaks (e.g. roads, trails, etc.). However, for some project areas fuel discontinuities do not exist and project boundaries may require construction of fuel breaks.

Features Common to All Alternatives: Desired Future Conditions (Vegetation Communities)

One of the main goals of the fire management program at Bandelier is to achieve ecologically sustainable vegetative conditions across broad vegetation communities by restoring a natural range of variability and bio- diversity. These vegetative conditions are described below as DFC's for each vegetation community. The fire management plan alternatives that are considered in this EA must aim to achieve these DFC's.

Desired future conditions of Bandelier's plant communities are based on inferences about the nature and status of these plant communities prior to historical landuse patterns (beginning around 1880). While precise information about vegetative characteristics (i.e. structure and composition) within Bandelier prior to 1880 is incomplete, historic accounts from oral, written, and photographic records provide some general impressions. Tree age class information can provide a higher resolution record of pre- 1880 forest structure, but only for the specific sites sampled. In addition, defining precise structural targets is complicated by spatial and temporal variability inherent in plant communities as influenced by site conditions, climate, and their effects on individual species recruitment and mortality. Process oriented, functional definitions for target conditions (i.e. in terms of a historic fire frequency and fire behavior) may be more practical since they acknowledge the inherent variability in natural systems. In addition, functional definitions can provide a realistic measure of community stability, since processes like fire can be directly correlated with stand structure. Since DFC's cannot be precisely defined on the basis of existing information, only general recommendations will be made. Target conditions will be

defined from both a structural and functional perspective. As additional information becomes available, we will continue to refine management objectives relative to desired future conditions.

Please see "Vegetation Communities" under the Biological Environment section of Chapter 3 (Affected Environment) for detailed descriptions of the vegetation communities mentioned below. See Figure 3.1 for a map of Bandelier's vegetation communities.

Juniper- shrub grasslands:

Desired future conditions for this type include grass, forb, and shrub dominated communities with scattered mature trees (<10% cover) and herbaceous ground cover sufficient to stabilize soils and carry fire (at intervals of less than 2 years). Isolated patches of juniper dominated woodlands (canopy cover >30%) may occur on shallow soil or rocky substrate sites.

Pinyon- juniper savannas and woodlands:

Desired future conditions for the pinyon- juniper savanna include a savanna- like community that maximizes a diverse shrub and grass- forb understory. Major tree species include both pinyon and juniper in varying proportions depending on local site conditions. Mature tree canopy coverage averages less than 15%, with herbaceous and/ or shrub ground cover sufficient to stabilize soils and carry fire (at intervals of 10- 25 years). These communities would typically be located on deeper and more productive soil sites where sufficient herbaceous cover can sustain frequent fires of intensity necessary to maintain open stand structure.

Desired future conditions in the pinyon- juniper woodland include tree dominated woodland communities with canopy coverages generally exceeding 30%; herbaceous understories are sparse with fire return intervals in excess of 25 years. These communities would typically be located on rocky, shallow soil sites which limit herbaceous productivity, limit fire frequency and intensity, and promote woody plant dominance.

Ponderosa pine savannas and forests:

Desired future conditions for this type are communities with ponderosa pine as the dominant tree overstory, but encompassing both a wide range of cover values (from open savanna with approximately 5% mature tree cover to nearly closed canopy) and mixed age structure (i.e. seedlings, mid- story trees, overstory trees, dead snags, and dead and down logs). Trees in excess of several hundred years would be scattered throughout with understories of grass- forb, shrub, and other tree species variable depending on aspect, elevation, and time since last fire. Overstory tree canopy cover and understory ladder fuels would generally be broken and patchy, effectively mitigating opportunities for continuous crown fire runs, while allowing limited torching of closed canopy patches. Accumulations of surface fuels (litter, duff, slash, logs, etc.) would be consumed periodically (every 5 to 15 years) by low intensity, surface fire avoiding widespread damage to soils, mature canopy root systems, and perennial herbaceous cover.

Mixed conifer forests:

Desired future conditions for the common sub- component (uneven age type) of this vegetation community are mixed conifer forests with several species sharing dominance depending on local site conditions and with a full range of age classes (i.e. seedlings, midstory trees, overstory trees, dead snags, and dead and down logs). Trees in excess of several hundred years would be scattered throughout with understories of grass- forb, shrub, and other tree species variable depending on aspect, elevation, and time since last fire. Overstory tree canopy cover and understory ladder fuels would be broken and patchy, effectively mitigating opportunities for continuous crown fire runs, while allowing limited torching of canopy patches. Accumulations of surface fuels (litter, duff, slash, logs, etc.) would be consumed periodically by low intensity, surface fire avoiding widespread damage to soils, mature canopy root systems, and perennial herbaceous cover. Fire disturbance would likely reveal former patches of montane meadow, aspen, and ponderosa types now embedded within the mixed conifer.

Desired future conditions for the uniform age mixed conifer type would be similar to current conditions with expectations that episodic crown fire will continue to impose mortality and recruitment cycles in excess of 100 years and maintain uniform stand structure.

Aspen groves:

Desired future conditions for this type include maintenance and possible expansion of existing clones through periodic fire disturbance. This is a dynamic community which is dependent on episodic fire mortality, sprouting, and establishment to maintain itself.

Montane grasslands, wet meadows and other grassland types:

Desired future conditions for these grassland types would be to expand existing acreage to reclaim areas recently colonized by mixed conifers during the last 100 years. Native herbaceous (grass and forb) and shrub species should predominate (with <5% tree cover) and cover of non- native species should be steady to declining. Boundaries of grassland and forest type continue to be dynamic over the span of hundreds of years relative to fire disturbance regime and climatic patterns.

Canyon slope complex:

Desired future conditions for this complex are maintenance of existing conditions, since this is considered to be one of the most intact plant communities within the Monument.

Canyon riparian:

Desired future conditions for this complex would include maintenance of dominant native overstory and understory species with associated reduction of exotic species. Maintenance of stable watershed conditions (i.e. through preservation of effective vegetative cover) and high water quality are also desired features of this system. Discharge and water quality are measured quantitatively at the Frijoles Gauge located near Monument headquarters.

Features Common to All Alternatives: Ethnographic Resources

Based on recent consultations with the six pueblos (Santa Clara, Santo Domingo, San Idlefonso, San Felipe, Zuni, and Cochiti pueblos) most closely affiliated with Bandelier, the Monument will conduct twice annual consultations with interested Pueblos before the implementation of fire management activities. At these meetings, the Monument will present treatment prescription plans, site specific treatment maps, and detailed archeological site maps. The Pueblos will be invited to express their concerns about sensitive cultural or ethnographic resources. Bandelier will also facilitate and participate in site visits with the Pueblos, if necessary. Mitigating measures related to ethnographic resources will be implemented where necessary and appropriate.

MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

Regardless of which alternative is implemented, a consistent set of mitigation measures will be applied to the actions proposed in the fire management plan to ensure that natural and cultural resources and the quality of visitor experiences are protected. The intent of the mitigation measures is to avoid, minimize, and mitigate adverse impacts whenever possible. Detailed descriptions of each mitigation measure are provided below. See Table 2.4 for a brief summary of the mitigation measures.

Mitigation Measures: Natural Resources

Special- Status Species (Plants and Wildlife):

During the planning phase of any fire management activity, the presence of special- status species in the area will be determined. Monument personnel will evaluate existing databases and maps and may request additional surveys for field verification. Site- specific mitigations will be developed and implemented. As per consultation with the U.S. Fish and Wildlife Service, appropriate mitigations will be implemented to protect federally listed species (see "Biological Assessment mitigation measures" below). WFURB actions will be constrained if they pose undesirable disturbance to important habitat for special- status wildlife, or if they threaten populations of special- status flora. If a prescribed fire unit includes habitat for special- status species, actions will be taken to avoid nesting season and/or other sensitive periods of time for plants and animals. Providing direct protection of certain areas (such as nesting trees), altering the time or season of burning, or simply not allowing fire into parts of the unit are examples of possible mitigation measures for sensitive plants and wildlife.

Additional mitigation measures specific to special status plants are listed below:

1a. Where possible, avoid ground disturbing activities such as line construction, manual or mechanical treatments, or pile burning in areas of known special status plant populations and in areas of suitable habitat (which includes moist, somewhat open, grassy understories in mixed coniferous forests of mesic canyon bottoms and relatively open, grassy pinyon- juniper woodlands of gentle slope, usually in proximity to basaltic canyon rims).
1b. Prohibit trail widening, trail anchored line construction, and canyon bottom line construction above Alcove House.
1c. Only in emergency situations, construct fire line through suitable habitat by using natural barriers such as the stream bed to delimit the burn area. As a last resort, if no natural barriers exist, construct fire line by using minimal line construction techniques (i.e., removal of duff layer only) to link natural barriers. Rehabilitate all fire line by pulling the duff back onto the line after the fire is declared out.
2) Monitor special status plant response to fire management activities.

Table 2- 4. Brief summary of mitigation measures that may be implemented as part of Bandelier's Fire Management Plan.

Topic	Mitigation Measure	Responsible Party
Special Status Species	Presence of species in the project area will be determined; seasonal restrictions may be implemented; certain nesting trees or important habitat may be protected from fire; fire may be restricted in some sensitive habitats. In or near special status plant populations: ground disturbance will be avoided; natural barriers will be used for fire line construction; fire line will be rehabilitated; plant response will be monitored.	Wildlife Biologist, Vegetation Specialist, and appropriate fire staff
Soils/Erosion	Mulching. Aerial or hand seeding with native plants. Contour felling and bucking of small trees or using straw wattles. Slashing by felling, lopping, limbing and scattering of trees. Sand/soil bags and trenching. Rock and log grade stabilizers. Check dams constructed with rock, fence, logs, straw bales, or straw wattles. Mechanical treatments will preferably be conducted when soil is frozen and/or with slash on the ground. Soil will be raked after treatments.	Appropriate fire staff and natural and cultural resources staff
Water Resources	Proportion of steep slopes burned in a watershed will be minimized; burns that are continuous up both sides of the vertical gradient of a watershed will be avoided; thinning activities will be conducted at least 200 ft. from stream.	Appropriate fire staff
Aspen and Deciduous Shrubs	Monitoring and research of deciduous species will be conducted; burning activities in selected aspen groves will be evaluated; exclosures will be created or installed for protection or study.	Appropriate fire staff and natural resource staff
Non- Native Species	Use of fire to control non- native species. Monitoring will be conducted before and after fire treatments and if non-native plants are found, removal techniques will be developed and/or fire practices may be modified.	Appropriate fire staff, Fire Effects Specialist, and natural resources staff
Pile Burning	Piles will be kept small (the size of a small car).	Appropriate fire staff
Snags and Slash	Flush cut snags and standing vegetation if they present a threat to human life or safety. Lop and scatter vegetation to 18 inches or less, burn during prescribed fire or pile burn outside of fire season (October- April). Cut snags and standing vegetation to control a wildland fire.	Appropriate fire staff and natural resource staff
Fire Retardant	Fire retardant will only be used for initial attack on a fire.	Appropriate fire staff
Cultural Resources	Pre- incident planning may include protection of known cultural resources as appropriate. Research and experimentation of effects of fire on cultural resources. Remove hazardous fuels from certain cultural sites. Crews will avoid or minimize walking over structural elements. Inform and educate crews on identification of cultural resources. Cultural or resource management staff will be on- site during incident response or fire management treatments to protect or avoid cultural resources. Cultural resource staff will aid in positioning crews, holding lines, spike camps, helispots, drop zones, and other fire suppression related activities to avoid or minimize impacts in culturally sensitive areas. Cultural staff will advise fire teams where emergency fuel reduction could reduce or avoid impacts on known important cultural resources.	Appropriate cultural resource staff or resource management staff and fire staff
	Archeological sites within fire management units will be treated through evaluating the removal of: dead trees from structural elements; 3- inch diameter and smaller trees (cactus and other non- tree vegetation will remain), large (> 5 in. diameter) ponderosa pine growing in structures. Larger (> 3 in. diameter) juniper trees growing in structures will be retained, unless determined to be detrimental to integrity or stability of structure. Dead, woody material (> 3 in diameter) will be hand carried off structural elements, lighter slash may remain.	Appropriate cultural resource staff or resource management staff and fire staff
Wilderness	All fire management activities proposed in wilderness will require the use of the Minimum Requirements Decision Guide to determine the appropriate tools necessary to accomplish management objectives. As a general rule, motorized and/or mechanized equipment will not be allowed in wilderness areas. Minimum Impact Suppression Tactics (MIST) will be used in all wilderness areas (Appendix D).	Appropriate fire staff
Air Quality	Monitoring of air quality within Monument and adjacent to project area. If smoke accumulation is above authorized limits, aggressive suppression actions will occur until air quality improves.	Appropriate fire and resource staff
Unplanned Fire Events	Resource advisors notified of fire ignition location. If features or resources are located that require mitigation, action points will be established and mitigation plans will be developed.	Appropriate natural and cultural resource staff and fire staff

Threatened or Endangered Species:

Only those mitigation measures specific to federally listed threatened or endangered species are included below.

Bald Eagle
General:

- There will be no manual or mechanical thinning actions or prescribed fire taking place within bald eagle winter roosting habitat.

WFURB Activities:

- A wildlife resource advisor would be consulted for any WFURB in bald eagle winter roosting habitat.
- Surveys for bald eagles may be conducted, and if roosting habitat is occupied, fire may be directed away from the area or be monitored to avoid destruction of critical roosting habitat components.
- WFURB would be constrained if undesirable disturbances to bald eagles or suitable roosting habitat occur.
- All suppression activities necessary to extinguish a WFURB would follow Minimum Impact Suppression Tactics (Appendix D).
- Large diameter trees and snags used for perching and roosting would be protected during fire management activities; and avoided during construction of hand lines used in suppression efforts.

Mexican spotted owl
General:

- All planned fire management activities within occupied SNA's will take place during the non- breeding season (1 September – 28 February).
- A wildlife resource advisor would be consulted for every fire management activity within suitable spotted owl habitat.
- Surveys to detect spotted owls would be conducted during the same year of the planned fire management activity and would precede that activity. Surveys would generally cover designated suitable nesting areas (SNAs) and nesting and roosting zones (NRZs) within 600 m of the planned fire management activity.
- If spotted owl presence is detected, occupancy/reproductive status surveys will be conducted to locate spotted owls and determine their nesting status.
- If spotted owls are nesting outside a mapped SNA, a new SNA will be established.

Thinning Activities within SNAs and NRZs:

- Only low soil impact mechanical apparatus would be used in all SNAs and NRZs outside wilderness areas. No chainsaws or mechanical thinning would be allowed inside SNAs and NRZs within designated wilderness.
- Retain as many of the naturally occurring large dead and down logs (>12 inches dbh) as possible.
- Maintain as much of the overstory as possible.
- Mortality of trees 18 inches dbh or larger shall be avoided.

Prescribed Fire and WFURB Activities within SNAs and NRZs:

- In general, backing fires will be used to limit the rate of spread and intensity of fires in those areas.
- Where fuels are heavy and relatively dry, low density strip fires or spot fires (placing spots of fire on the ground at specified intervals as opposed to a continuous line) will be used within SNAs.
- If conditions favor relatively intense fire behavior and undesirable effects, SNAs will be treated at night using the appropriate firing direction and pattern.
- Fuel pockets will be manually broken up, during the non- breeding season, to prevent excessive heat exposure to individual overstory trees in SNAs during prescribed fires.
- A spotted owl advisor will work directly with the burn boss on all prescribed fires that involve either an occupied SNA or assumed occupancy NRZ.
- WFURB would be constrained if undesirable disturbances to spotted owls or suitable habitat occur.

Monitoring Activities:

- Mexican spotted owls and their habitat will be monitored to confirm anticipated effects and to detect any unanticipated effects.
    - Photo points will be established in all SNAs to record before, immediately post burn, and 5 years post burn.
    - Spotted owl occupancy and reproductive status will be monitored before and after fires in any SNA.

Soils:

During any fire management activity, impacts to soils will be minimized and areas with a high probability of erosion will be stabilized by utilizing the best available technology and rehabilitation methods. These methods will be determined by Monument fire and resource management staff, and could include the following: mulching, seeding with native plants, contour felling, slashing, sand/soil bags, trenching, grade stabilizing, and check dams. For each method where digging is involved, site specific archeological compliance will be conducted to avoid impacts to cultural resources. A brief description of each method is below.

Mulching:
Mulching is an effective tool for providing instant ground cover to reduce the erosive action of raindrops hitting bare soil and to disperse overland flow. Mulching may be used on highly erodible soils, areas that burned very hot and lost all ground cover, and on fire lines that have crossed drainages. Hand Mulching provides 100% ground cover on sensitive sites, but is an expensive, labor intensive treatment. Strip mulching is less expensive and may be more practical in some areas. It is applied in contour strips about 25 to 50 feet apart on burned slopes, covering approximately 50% of the land surface. Mulching may be used in conjunction with seeding to provide a protective cover for seeds and reduce soil moisture evaporation.

Seeding with native plants:
Seeding with native plants can be used to provide ground cover that will protect the soil from raindrop splash and surface runoff. It can also provide a stabilizing root mass to bind soil particles together. Seeding may be used to protect areas with highly erodible soils, areas that burned hot and lost all ground cover, areas adjacent to drainages that burned hot, and areas where the soil seed bank was destroyed. Seeding can be accomplished aerially or by hand. Aerial seeding has a rapid production rate and a low cost per acre. Hand seeding is optimal in small areas, usually less than 25 acres.

Contour felling:
Contour felling can be used to catch and hold soil and sediment, and to disperse overland water flow. This treatment can be applied by felling small trees, bucking them to a manageable length, and limbing them so they lay flat on the soil surface. They can then be placed on contour and, where possible, braced against stumps.

Straw wattles are tube- shaped bundles of straw of various lengths that can also be used to provide an effective barrier to soil movement. They work following the same principle as contour felling.

Slashing:
Slashing can be used to increase ground cover, stabilize soils, protect plant seeds, and reduce erosion. This treatment involves felling, lopping, limbing, and scattering of trees. It is most effective on lower angle slopes.

Sand/soil bags:
This treatment involves digging a shallow trench, using the soil removed from the trench to fill sand bags, and placing the filled sand bags directly down slope from the trench. The trench provides a catchment area for soil moving downhill and the sand bags provide a contour barrier.

Trenching:
Trenches can be dug with hand tools or with machinery (following the Minimum Requirements Decision Guide (Arthur Carhart National Wilderness Training Center, 2002) (hereafter, Carhart Center, 2002) and approval from the Superintendent), depending on the location. Trenches can disperse water flow, provide areas for water infiltration, and provide a catchment site for soil moving downhill. This is a useful treatment on soils with hydrophobic layers within 6 inches of the surface and areas that have little or no other on site material.

Grade stabilizing:
Grade stabilizing reduces channel down cutting, decreases water velocity, and maintains correct width/depth ratios in streams. It reduces sediment load in perennial streams by trapping and metering sediment through the system. There are two different types of grade stabilizers that may be used: rock grade stabilizers and log grade stabilizers. Rock grade stabilizers are generally used in smaller, intermittent, or ephemeral streams where there is plenty of rock on the surrounding slopes (rock is not removed from the streambed to construct the dam). Rock dams require organic matter, such as twigs, duff, and conifer needles to seal the structure properly. Log grade stabilizers are also used in smaller, intermittent, or ephemeral streams. There must be dead standing or down wood nearby to construct the dam.

Check dams:
Check dams can be used in intermittent or small perennial drainages to replace large debris that may have been burned out during the fire. Check dams prevent sediment from entering perennial streams and provide a barrier to soil movement. They can be constructed with rock and fence, logs, straw bales, or straw wattles.

Additionally, the following mitigation measures in regard to mechanical treatments will be implemented:

- Minimize the effects of soil compaction due to mechanical thinning activities by spreading slash on the ground.
- Conduct mechanical thinning activities during winter months when the soil is frozen.
- Rake appropriate areas after mechanical treatments.

Water Resources:

The following mitigation measures in regard to water resources will be implemented:

- For prescribed fire, minimize the proportion of steep slopes (> 30%) within a watershed that are burned to minimize sediment loading.
- Avoid conducting burns that have the potential to be continuous up both sides of the vertical gradient of a watershed.
- When possible, conduct thinning activities at least 200 feet away from streams.

Aspen and Deciduous Shrub Species:

The following mitigation measures in regard to aspen and deciduous shrub species will be implemented:

- Fire and resource personnel will conduct monitoring and research of aspen and deciduous shrub species response to fire.
- Implement mitigation measures prior to prescribed burning if deemed necessary by research and monitoring results. Examples of mitigation measures may include but are not limited to: 1) evaluate burning activities in selected aspen groves based on information gathered from research and monitoring, and 2) create or install exclosures to protect or study response of deciduous species.

Non- native Species:

Control of non- native plant species with fire

Fire may be an effective tool for managing some non- native plant species. If fire is determined to be the appropriate tool for control of non- native species, the Fire Management Division would prepare a prescribed fire plan. This prescribed fire plan would include fire prescriptions, site preparation plans, and monitoring needed to carry out the non- native species control actions.

Non- native species invasion and fire management activities

Recognizing that fire management activities cause disturbance, opportunities exist for non- native plant species colonization. For example, in some areas fire suppression has contributed to the invasion of non- native thistles. The Fire Management Division is responsible for the monitoring of non- native plants before (if possible) and after fires through its Fire Effects Monitoring/Fire Ecology Program. This monitoring will continue and the Fire Management Division will participate in efforts to control non-native species. If non- native plants are found, the Monument Fire Ecologist and natural resources staff will develop appropriate mitigation measures (i.e. cutting seed heads and manually removing plants). Additionally, the Fire Management Division will modify their prescribed fire practices if certain activities are determined to contribute to invasions of non- native plants.

Pile Burning:

To ensure that impacts from pile burning would be minimized, piles would be kept small (the size of a small car) to minimize the extent of vegetation and soil damage and also to allow mycorrhizal fungi and other soil organisms to re- colonize patches of sterilized soil. This would also facilitate nutrient cycling processes and help plants to reestablish.

Snags and Slash:

Snags (standing dead trees) and other standing vegetation are generally cut during fire management activities when they present a threat to human life and safety or are a hazard to property or a valued resource. They may also be felled to control a wildland fire. In the event that a snag or live vegetation must be cut down, it will be cut flush with the ground (or as close to the ground as possible).

Debris from cut vegetation (slash) will either be lopped and scattered to a depth of no more than 18 inches and burned during a subsequent prescribed fire, or piled and burned outside of fire season (October- April).

Mitigation Measures: Cultural Resources

Pre- incident planning

- Planning for fire management actions will include protection of known cultural resources using various measures as recommended by cultural resource staff and as identified in the Memorandum of Agreement (MOA) with the State Historic Preservation Office (SHPO) (see MOA with SHPO below).
- Cultural resource inventories will be completed for each fire management project area to identify resources that may be important and are susceptible to adverse impacts from fire or fire management actions.
- Known cultural resources will be evaluated for hazardous fuels, and those fuels may be reduced as part of ongoing fuel reduction programs.
- Bandelier will conduct long- term research and experimentation about the effects of fire on cultural resources.
- Bandelier will continue to consult with Native American tribes about fire management planning and specific fire management actions in order to identify issues and resources of concern and to implement the most appropriate treatments.
- In traditional use areas, fire managers will consider the needs of cultural practitioners to access and use traditional resources.

Incident response

- Fire management teams will solicit the advice of archeologists, cultural resource specialists, and/or other resource management staff on cultural resource issues and concerns to avoid impacts to cultural resources.
- To avoid damage to cultural resources, archeologists, cultural resource specialists, and/or other resource management staff will, whenever possible, aid in positioning crew camps, holding lines, spike camps, helispots, drop zones, and other fire suppression related activities in culturally sensitive areas.
- Archeologists, cultural resource specialists, and/or other resource management staff will be assigned to fire management teams to advise of known important cultural resources in areas where potential impacts of fire could be reduced or avoided through emergency fuel reduction.

The possible impacts of fire and fire management activities on cultural resources are described in chapter 1: Purpose and Need for Action under Table 1.4 "Impact Topics and Issues Related to the Development and Implementation of Bandelier's Fire Management Plan." These impacts will be mitigated by the following actions:

- Prior to the start of work, archeologists, cultural resource specialists, or other resource management staff will instruct crews in identification of cultural materials and review federal and state laws protecting archeological sites and artifacts.
- All cultural sites within the project area will be identified and located by an archeologist, cultural resource specialist, or other resource management staff member. These sites may be avoided during fire management activities.
- An archeologist, cultural resource specialist, or resource management staff member will be present on site during fire management treatments to identify structural elements, supervise directional tree felling, and placement of slash.
- Crews will avoid or minimize walking over structural elements.
- Following each project or treatment, a report will be sent to the SHPO.

Archeological sites within fire management units will be treated under the same conditions as prescribed for the surrounding vegetation with the following modifications:

- Dead trees, regardless of species, will be evaluated for removal from structural elements of sites. Non- structural elements of sites will be treated using the same prescription as for the surrounding landscape.
- Three inch diameter and smaller trees will be evaluated for removal. Cactus and other non- tree vegetation will be retained.
- Larger (> 3 inch) diameter junipers growing in structures will be retained unless an Archeologist, cultural resource specialist, or resource management staff member determines it would be detrimental to the stability or integrity of the structure.
- Larger (> 5 inch) diameter unstable ponderosa pines growing in structures will be removed.
- Heavy fuels (any dead woody material greater than 3- inch diameter) will be hand-carried off structural elements. Lighter slash can remain per recommendation of an Archeologist, cultural resource specialist, or resource management staff member.

Memoranda of Agreement (MOA) with the State Historic Preservation Office

All fire management actions and activities must follow the guidelines established in the FMP MOA for §106 consultation on a project specific basis. This MOA will be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans define the proposed actions, and the anticipated level of fire intensity and resulting severity of impacts on cultural resources will also be identified if the project includes prescribed fire. Project areas that contain unsurveyed tracts of land on slopes less than 30 degrees will be subjected to intensive surveys. Project areas that have been previously inventoried will be assessed for the presence of historic properties through examination of Bandelier's cultural resource base maps, the Monument's archeological site database, and the List of Classified Structures (LCS). Monument archeologists will visit each known site within a proposed project area and assess the potential for adverse effects. In this site- specific assessment, the archeologist will determine whether any sites will require special protective measures to mitigate the effects of the project.

The Monument, in consultation with the SHPO, will follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within an Area of Potential Effect (APE). Furthermore, the Monument will seek comments from all potentially interested Pueblo Indian groups, pursuant to National Register Bulletin 38, in order to identify potential Traditional Cultural Properties (TCPs) located within the APE, and will then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register will be submitted to the SHPO for concurrence.

For every prescribed fire plan, the Monument will document the results of the field inventory and consultation efforts with Pueblos regarding properties of traditional religious and cultural value, and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with SHPO and other consulting parties, the Monument will submit the report for review and comment. The report will present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)(1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)(1).

If avoidance of adverse effects is not possible, the Monument will work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or thinning activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

Mitigation Measures: Fire Retardant

To minimize impacts to natural and cultural resources, fire retardant will only be used for initial attack on a fire. Beyond initial attack, it will require approval from the Superintendent.

Mitigation Measures: Wilderness

National Park Service Management Policies, Section 6.3.9 states the following:

"Fire management activities conducted in wilderness areas will conform to the basic purposes of wilderness. The park's fire management and wilderness management plans must identify and reconcile the natural and historic roles of fire in the wilderness, and will provide a prescription for response, if any, to natural and human- caused wildfires. If a prescribed fire program is implemented, these plans will also include the prescriptions and procedures under which the program will be conducted within wilderness. Actions taken to suppress wildfires will use the minimum requirement concept, and will be conducted in such a way as to protect natural and cultural resources and to minimize the lasting impacts of the suppression actions."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except under conditions that warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002) to determine whether motorized tools would be more effective in a particular case. According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

Minimum impact suppression tactics will be used in wilderness (see Appendix D for a summary of minimum impact suppression techniques). Slash and debris may be scattered to reduce the visual effects in wilderness.

Mitigation Measures: Air Quality

All prescribed burning and pile burning will comply with State of New Mexico air quality guidelines and smoke management regulations. A site- specific prescribed burn plan will be prepared for each project and will include all of the required elements related to air quality in RM- 18.

Monument staff will monitor air quality adjacent to project areas and within developed areas of the Monument. Unhealthy or hazardous accumulations of smoke will trigger an aggressive suppression action that will continue until the air quality attains acceptable levels. When adjacent land management agencies are managing prescribed fires or wildland fires, cooperation and coordination will be initiated to minimize cumulative smoke impacts.

Mitigation Measures: Unplanned Fire Events

In the case of unplanned events, such as WFURB, Monument resource advisors will immediately be notified of the fire ignition location and of the intent to manage the fire within a maximum manageable area (MMA). If necessary, efforts will be made to send resource specialists into the area to perform basic inventory work. If resource advisors locate features or resources that require mitigation, *action points* (geographic locations at which mitigation actions are triggered if fire reaches the point) will be established and mitigation plans developed. If the fire reaches an action point, the mitigation plan will be implemented. It may take several days to weeks before this occurs, or it is also possible that the fire may not reach the identified action point.

ALTERNATIVES UNDER CONSIDERATION

Bandelier's IDT agreed upon a range of reasonable fire management alternatives in an internal scoping meeting in 2003. These alternatives were refined after the public scoping sessions and then finalized in 2004. Alternatives 1 and 2 have been carried forward for detailed analysis and are described in detail below.

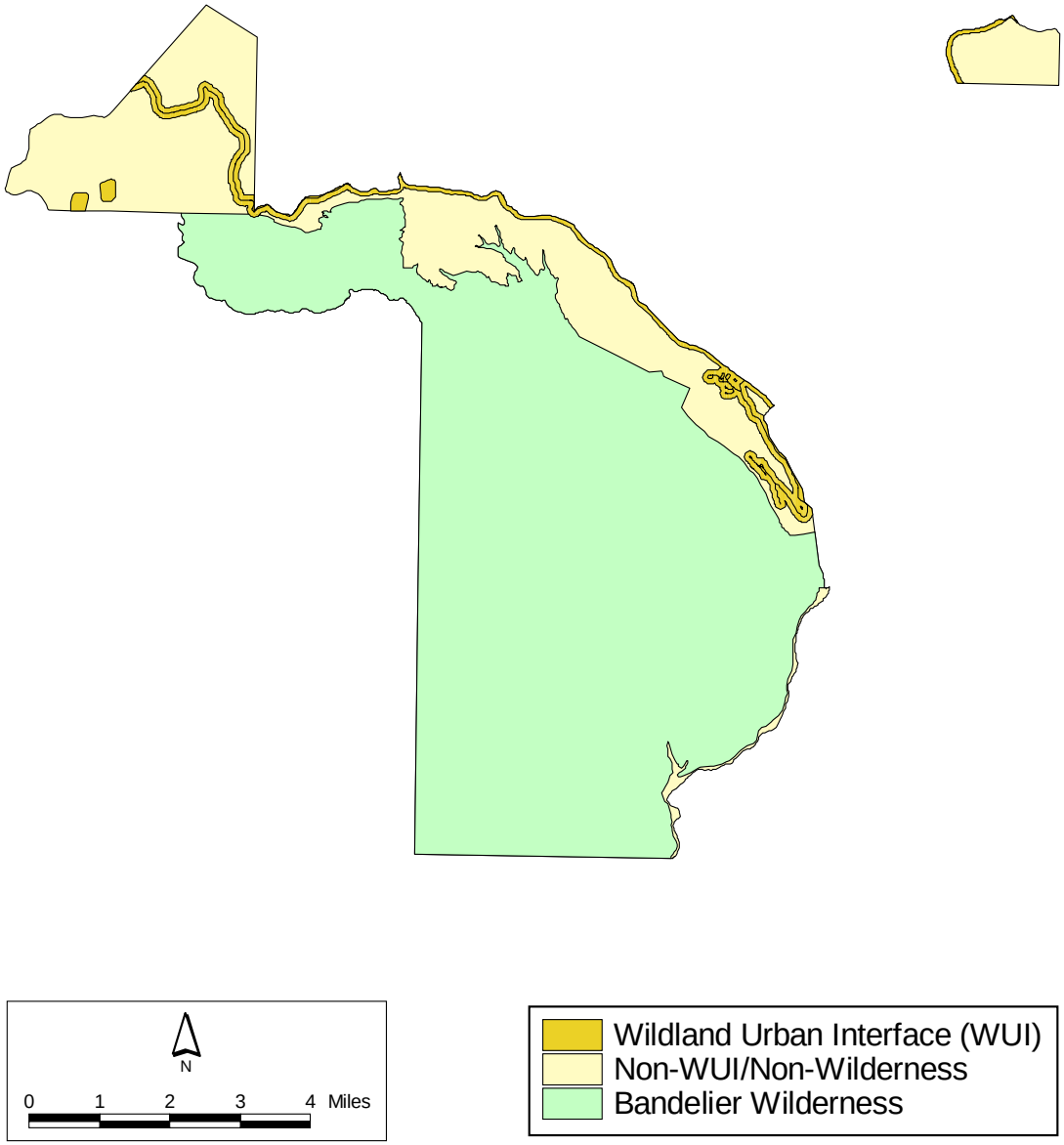
Alternative 1: No Action Alternative (Maintain Existing Plan)

Under the No Action Alternative, Bandelier's existing (1997) Fire Management Plan would be maintained and current fire management activities would continue. The current plan utilizes fire suppression, prescribed fire, and WFURB. In Bandelier's Unit 1 (fire suppression unit) (Figure 2.1), all natural fire ignitions are suppressed. WFURB's are permitted to burn in Unit 3 (WFURB unit) (Figure 2.1) under specific environmental conditions with adequate personnel and support available to achieve defined objectives. Prescribed fires are used in all areas of the Monument for the purposes of hazard fuel reduction and achieving ecological restoration objectives. Both prescribed fires and WFURB are monitored by a systematic process of collecting and recording data on safety conditions, vegetation, topography, weather, air quality, and fire behavior and effects. This information is then used to determine if the fire is staying within prescription and if fire and resource management goals and objectives are being met.

Mechanical thinning under this plan includes all possible mechanized apparatus (such as chippers, loaders, etc), although no dozers are allowed in the Monument. Manual and mechanical thinning are allowed in non- WUI, non- wilderness areas (Figure 2.4) under the following conditions: 1) in montane meadows, where in most cases the application of fire has little or no affect on trees invading these grasslands, 2) within altered forest structure, where the application of fire will not meet reduction objectives, 3) within and around cultural sites, where woody removal reduces potential exposure to high levels of heating, and 4) in and around park structures and improvements, where exposure to fire may result in damage or loss. The WUI (Figure 2.4) is not emphasized in this management plan, but manual and mechanical thinning are allowed, following the above conditions. Mechanical thinning is not allowed in wilderness (Figure 2.4), except in suppression situations, following the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent.

Fuels are removed through prescribed broadcast burning, WFURB, or pile burning. Mitigation measures specific to natural and cultural resources would be implemented under this Alternative.

Figure 2.4 Wildland Urban Interface, Non-WUI/ Non-Wilderness, and Wilderness in Bandelier National Monument



9/27/04 K.Beeley, Bandelier National Monument

Summary of Actions Under Alternative 1:

Unit 1 (fire suppression unit):

Non- WUI, non wilderness:

Fire suppression, prescribed fire, manual and mechanical thinning are allowed in areas where forest structure has been altered or where cultural resources and developed areas may be adversely affected from fire, fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Not defined or emphasized under this plan, but allows for fire suppression, prescribed fire, manual and mechanical thinning in areas where forest structure has been altered or where cultural resources and developed areas may be adversely affected from fire. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wilderness:

Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, and manual thinning with hand tools. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

Unit 3 (WFURB unit):

Non WUI, non wilderness:

Fire suppression, prescribed fire, WFURB, manual and mechanical thinning are allowed in areas where forest structure has been altered or where cultural resources and developed areas may be adversely affected from fire. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Not defined or emphasized under this plan, but allows for fire suppression, prescribed fire, WFURB, manual and mechanical thinning in areas where forest structure has been altered or where cultural resources and developed areas may be adversely affected from fire. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wilderness:

Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, WFURB, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a, use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

Alternative 2: Multiple Strategy Program

Under the Multiple Strategy Program, fire management actions at Bandelier would include fire suppression, prescribed fire, and WFURB. In Bandelier's Unit 1 (suppression unit) (Figure 2.1), all natural fire ignitions would be suppressed. WFURB's would be permitted to burn in Unit 3 (WFURB unit) (Figure 2.1) under specific environmental conditions with adequate personnel and support available to achieve defined objectives. Prescribed fires would be used in all areas of the Monument for the purposes of hazard fuel reduction and achieving ecological restoration objectives. Both prescribed fires and WFURB would be monitored by a systematic process of collecting and recording data on safety conditions, vegetation, topography, weather, air quality, fire behavior and effects. This information would then be used to determine if the fire is staying within prescription and if fire and resource management goals and objectives are being met.

Mechanical thinning under this plan includes only low soil impact mechanized apparatus (such as hydromulchers). Manual (chainsaws and hand tools) thinning is not allowed in non- WUI, non- wilderness areas (Figure 2.4) except with approval from the Superintendent. Mechanical thinning is not allowed in non- WUI, non- wilderness areas, except in suppression and with approval from the Superintendent. The WUI (Figure 2.4) is specifically defined and emphasized in this alternative. Both manual and mechanical thinning are allowed in the WUI. Manual thinning with chainsaws and mechanical thinning are not allowed in wilderness (Figure 2.4), or in areas where wilderness suitability has not been determined, except in suppression situations, following the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent.

Forest fuels are removed through prescribed broadcast burning, WFURB, or pile burning. Mitigation measures specific to natural and cultural resources would be implemented under this Alternative.

The differences between this alternative and the No Action Alternative (Alternative 1) are:

- Mechanical thinning under this plan includes only low soil impact mechanized apparatus (such as hydromulchers).
- Manual (chainsaws and hand tools) thinning is not allowed in non- WUI, non-wilderness areas, except with approval from the Superintendent.
- Mechanical thinning is not allowed in non- WUI, non- wilderness areas, except in suppression and with approval from the Superintendent.
- The WUI is emphasized under this alternative.
- Mitigation measures are emphasized in this fire management plan.
- Manual thinning with chainsaws and mechanical thinning are not allowed in areas where wilderness suitability has not been determined, except in suppression situations, following the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent.

Summary of actions proposed under Alternative 2:

Unit 1 (fire suppression unit):

Non WUI, non wilderness:

Activities include fire suppression, prescribed fire, manual thinning (chainsaws and hand tools) with Superintendent approval, and mechanical thinning only in suppression situations and with Superintendent approval. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Fire suppression, prescribed fire, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wilderness:
Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

Unit 3 (WFURB unit):

Non WUI, non wilderness:

Activities include fire suppression, prescribed fire, WFURB, manual thinning (chainsaws and hand tools) with Superintendent approval, and mechanical thinning only in suppression situations and with Superintendent approval. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Fire suppression, prescribed fire, WFURB, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as described under "Mitigations Common to All Alternatives."

Wilderness:

Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, WFURB, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning, WFURB, or pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

Alternative 3: Aggressive, Multiple Strategy Program

Under the Aggressive Multiple Strategy Program, fire management actions at Bandelier would include fire suppression, prescribed fire, and WFURB. In Bandelier's Unit 1 (suppression unit) (Figure 2.1), all natural fire ignitions would be suppressed. WFURB's would be permitted to burn in Unit 3 (WFURB unit) (Figure 2.1) under specific environmental conditions with adequate personnel and support available to achieve defined objectives. Prescribed fires would be used in all areas of the Monument for the purposes of hazard fuel reduction and achieving ecological restoration objectives. Both prescribed fires and WFURB would be monitored by a systematic process of collecting and recording data on safety conditions, vegetation, topography, weather, air quality, fire behavior and effects. This information would then be used to determine if the fire is staying within prescription and if fire and resource management goals and objectives are being met.

Under this alternative, both manual (chainsaws and hand tools) and mechanical thinning are allowed in non- WUI, non- wilderness areas (Figure 2.4) and do not require the use of the Minimum Requirements Decision Guide (Carhart Center, 2002). The WUI (Figure 2.4) is specifically defined and emphasized in this fire management plan. Both manual and mechanical thinning are allowed in the WUI. Manual thinning with chainsaws and mechanical thinning are not allowed in wilderness (Figure 2.4) except in suppression situations, following the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Manual thinning with chainsaws and mechanical thinning are allowed in areas where wilderness suitability has not been determined.

Forest fuels are removed by burning on or off site by the fastest means possible. This could include prescribed broadcast burning, WFURB, pile burning, or hauling and burning off-site. Mitigation measures specific to natural and cultural resources would be implemented under this Alternative.

The differences between this alternative and the No Action Alternative (Alternative 1) are:

- Both manual (chainsaws and hand tools) and mechanical thinning are allowed in non- WUI, non- wilderness areas without the constraints listed under the No Action Alternative (Alternative 1).
- The WUI is emphasized under this fire management plan.
- Mitigation measures are emphasized in this fire management plan.
- Manual thinning with chainsaws and mechanical thinning are allowed in areas where wilderness suitability has not been determined.

Summary of actions proposed under Alternative 3:

Unit 1 (fire suppression unit):

Non WUI, non wilderness:
Fire suppression, prescribed fire, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by the fastest means possible: prescribed broadcast burning, pile burning, or hauled and burned off- site. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Fire suppression, prescribed fire, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by the fastest means possible: prescribed broadcast burning, pile burning, or hauled and burned off- site. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wilderness:
Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

Unit 3 (WFURB unit):

Non WUI, non wilderness:

Fire suppression, prescribed fire, WFURB, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by the fastest means possible: WFURB, prescribed broadcast burning, pile burning, or hauled and burned off- site. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wildland/Urban Interface (WUI):
Fire suppression, prescribed fire, WFURB, manual thinning (chainsaws and hand tools), and mechanical thinning are allowed. Fuels are removed by the fastest means possible: WFURB, prescribed broadcast burning, pile burning, or hauled and burned off- site. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Wilderness:

Fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, WFURB, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning, pile burning, and WFURB. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

This alternative was eliminated from detailed analysis for the following reasons:

Alternative 3 was developed from IDT discussions and public comments received during the scoping period. Several comments called for more aggressive fire management activities in the Monument.

Section 1502.14 of CEQ's *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500- 1508) clearly states that agencies "…shall rigorously explore and objectively evaluate all reasonable alternatives…." Under *NEPA's Forty Most Asked Questions* (CEQ 1981), "reasonable alternatives include those that are practical and feasible from the technical and economic standpoint and using common sense…." Using these guidelines, Alternative 3 was considered a reasonable alternative for implementation. Analysis of the environmental impacts showed that there would be the potential for major adverse effects to certain environmental resources in the Monument if Alternative 3 was implemented. These impacts would primarily result from the use of high impact mechanical thinning apparatus, such as bulldozers, in the WUI, the non- WUI, non- wilderness, and in areas not yet studied for wilderness suitability. A summary of these potential major adverse effects are described below:

Vegetation: Major adverse effects from soil compaction, vegetation trampling, and vegetation removal.

Special Status Species (Wildlife): Major to moderate adverse effects to the Goat Peak pika and Jemez Mountains salamander from direct injury or mortality and substantial ground disturbance, which may negatively affect or decrease prey abundance, habitat substrate, or forage.

Special Status Species (Plants): Major to moderate adverse impacts from degradation of suitable and potential habitat.

Soils and Water Resources: Major adverse impacts to soils from alteration of soil structure, porosity, density, and infiltration capacity, and in an extreme case, a loss of upper soil horizons. Soil compaction, instability of slopes, and increased soil erosion are all possible under aggressive fuel reduction techniques. It is likely that sediment yield, nutrient yield, water yield, peak flows, channel response and riparian communities would be adversely affected.

Archeological Resources: Major adverse impacts to surface archeological sites and artifacts may occur as well as damage to subsurface materials. The impacts from substantial ground disturbance of sites and displacement of artifacts may be permanent and irreparable and may constitute an adverse effect under §106 of the NHPA.

Cultural Landscape Resources: Major adverse impacts from significant ground disturbance and removal of important landscape features in cultural landscape or historic site settings. This may be permanent and irreparable and may constitute an adverse effect under §106 of the NHPA.

Based on the impact analyses, Alternative 3 could not be implemented because of the potential for major adverse impacts to vegetation, special status species (wildlife and plants), soils and water resources, archeological resources, and cultural landscape resources. National Park Service policy in DO- 12 (NPS 2001a) states that "…if the impact analysis shows that a technically or economically feasible alternative would have profound adverse environmental impacts, it should be eliminated as 'environmentally infeasible'". The activities described under Alternative 3 are technically or economically feasible; however, the use of high impact mechanical apparatus could cause major adverse

environmental impacts to Monument resources, thus making the alternative environmentally infeasible. Therefore, Alternative 3 was considered but eliminated from further analysis.

Alternative 4: Non- fire Program

Under the Non- fire program, fire management activities at Bandelier would include only one of the available fire management strategies: fire suppression. All fire ignitions in the Monument would be suppressed. No WFURB or prescribed broadcast fires would be allowed.

Mechanical thinning under this plan includes all possible mechanized apparatus (such as chippers, loaders, dozers, etc). Both manual (chainsaws and hand tools) and mechanical thinning are allowed in non- WUI, non- wilderness areas (Figure 2.4) and do not require the Minimum Requirements Decision Guide (Carhart Center, 2002). The WUI (Figure 2.4) is specifically defined and emphasized in this management plan. Both manual and mechanical thinning are allowed in the WUI. Manual thinning with chainsaws and mechanical thinning are not allowed in wilderness (Figure 2.4) except in suppression situations, following the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Manual thinning with chainsaws and mechanical thinning are allowed in areas where wilderness suitability has not been determined.

Forest fuels are removed through pile burning on or off site or hauled away. Mitigation measures specific to natural and cultural resources would be implemented under this Alternative.

The difference between this alternative and the No Action Alternative (Alternative 1) is:

- Mechanical thinning under this plan includes the use of dozers.
- Both manual (chainsaws and hand tools) and mechanical thinning are allowed in non- WUI, non- wilderness areas without the constraints listed under the No Action Alternative (Alternative 1).
- The WUI is emphasized under this fire management plan.
- Mitigation measures are emphasized in this fire management plan.
- Manual thinning with chainsaws and mechanical thinning are allowed in areas where wilderness suitability has not been determined.
- Prescribed broadcast fires and WFURB are not allowed in the Monument.

Summary of actions proposed under Alternative 4:

This alternative negates the need for units. Actions would include:

> **Non WUI, non wilderness and Wildland/Urban Interface (WUI):**
> Fire suppression, manual thinning (chainsaws and hand tools), and mechanical thinning (vehicles and equipment such as chippers, loaders, dozers, etc.) are allowed. Fuels are removed by pile burning on or off site or hauled away. Mitigations are conducted as described under "Mitigations Common to All Alternatives."
>
> **Wilderness:**
> Fire suppression (following Minimum Impact Suppression Tactics) and manual thinning with hand tools are allowed. Fuels are removed by pile burning on or off site or hauled away. Mitigations are conducted as detailed under "Mitigations Common to All Alternatives."
>
> All fire management activities in wilderness are conducted without the use of motorized equipment or transport, except when conditions warrant an evaluation using the Minimum Requirements Decision Guide (Carhart Center, 2002). According to NPS Management Policies (NPS, 2001a), use of motorized equipment in wilderness will be authorized only "if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or in emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including minimum requirement protocols as practicable."

This alternative has been eliminated because it would not meet the following fire and resource management goals for the reasons listed below.

- "Provide the means for staff and the public to preserve, protect, understand, and enjoy the natural and cultural resources of Bandelier National Monument through an integrated program where management activities support naturally functioning ecosystems consistent with cultural resource preservation needs." Because fire is a natural disturbance process in the Jemez Mountains, a non- fire program does not support the concept of naturally functioning ecosystems.
- "Achieve ecologically sustainable vegetative conditions across broad vegetation communities by restoring a natural range of variability and bio- diversity. Ecologically sustainable vegetative conditions cannot be achieved through a non-fire program because this program would not enable managers to achieve DFC's for the various vegetation communities described in Chapter 2, under "Features Common to All Alternatives." In addition, eliminating fire as a natural disturbance process has moved Bandelier's vegetation communities outside the natural range of variability and has contributed to a loss in biodiversity.

This alternative also does not meet the following fire and resource management objectives:

- Restore and maintain fire- dependent ecosystems with the appropriate use of fire.
- Use prescribed fire to meet fire and resource management goals and objectives.
- Allow natural fires to function in fire dependent ecosystems.

Additionally, it is unlikely that sufficient staff or funding would be available to manually or mechanically treat all areas in the Monument to reduce hazardous fuels and the likelihood of unwanted fire.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is defined as "the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (Forty Most Asked Questions Concerning Council on Environmental Quality's National Environmental Policy Act Regulations, 1981).

The goals characterizing the environmentally preferable condition are described in Section 101 (42 USC section 4331) of NEPA: "….it is the continuing responsibility of the Federal Government to …1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations, 2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings, 3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences, 4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice, 5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities, and 6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The environmentally preferred alternative was selected after evaluating: 1) how the alternatives complies with NEPA goals above, 2) how the alternatives contribute to the damage of the biological and physical environment, and 3) how well the alternatives protect, preserve, and enhance historic, cultural, and natural resources.

Compliance with the NEPA goals

Alternative 1 represents the current fire management direction for Bandelier. This fire management plan adequately fulfills all the provisions of the NEPA goals as stated above. However, because this plan does not emphasize activities in the WUI, goals 1, 2, 3, and 4 are not fully realized. The compliance with provisions 1, 2, and 3 could be further compromised under this fire management plan because the definition and use of manual and mechanical thinning are not clearly described. Under a very liberal interpretation, the over- use of either manual or mechanical thinning could potentially compromise the environment for succeeding generations (provision 1), and result in environmental degradation (provision 3) and surroundings that are not aesthetically and culturally pleasing (provision 2).

Alternative 2 is the Multiple Strategy Program. This alternative is superior to Alternative 1 in fulfilling all the provisions of NEPA goals as stated above because this plan ensures that provisions 1, 2, and 3 of the NEPA goals are taken into consideration when employing such activities.

After careful review of potential resource and visitor impacts of the alternatives under consideration, and taking into account the proposed mitigations for impacts to natural and cultural resources under both Alternatives, it was determined that the environmentally preferred alternative is Alternative 2. Alternative 2 surpasses Alternative 1 in realizing the full range of NEPA goals as stated in Section 101 of NEPA; contributes the least damage to the biological and physical environment; and best protects, preserves, and enhances historic, cultural, and natural resources.

SELECTION OF PREFERRED ALTERNATIVE

The planning team recommended Alternative 2 as the preferred alternative. The preferred alternative was chosen after evaluating each alternative based on: 1) how well it achieved the purpose of and need for the Bandelier Fire Management Plan, 2) how well it achieved fire and resource management goals and objectives as described in Chapter 1: Purpose and Need, 3) how well it addressed issues and concerns expressed by the public, and 4) how well it promoted the NEPA goals as expressed in NEPA Section 101.

Refer to Appendix E for a tentative multi- year fuels plan. This plan is an example of the type and size of fire management projects and activities that may be implemented under this fire management plan. It is a dynamic document that is meant to be reviewed and updated annually.

SUMMARY OF ALTERNATIVES UNDER CONSIDERATION

Table 2.5 summarizes important features of the alternatives considered for detailed analysis and the degree to which each alternative meets the fire management plan purpose, need, goals, and objectives. Table 2.6 summarizes the environmental consequences and reviews the overall impacts of each alternative by topic. Impacts are analyzed in greater detail in Chapter 4.

Table 2.5 Summary of alternatives under consideration

		Alternative 1: No Action	Alternative 2: Multiple Strategy
Fire management strategies that would be used	Suppression	Yes	Yes
	Prescribed fire	Yes	Yes
	WFURB	Yes	Yes
	Non- fire treatments	**Wilderness:** Manual and mechanical thinning not allowed unless in suppression, using the Minimum Requirements Decision Guide, and with approval from Superintendent. **WUI:** Not emphasized, but manual and mechanical thinning allowed (no dozers). **Non- WUI, non- wilderness:** Manual and mechanical thinning allowed (no dozers).	**Wilderness:** Manual and mechanical thinning not allowed unless in suppression, using the Minimum Requirements Decision Guide, and with approval from Superintendent. **WUI**: Manual and mechanical thinning allowed. **Non- WUI, non- wilderness:** Manual thinning not allowed, except with approval from Superintendent. Mechanical thinning not allowed, except in suppression and with approval from Superintendent.
Degree to which the alternative would meet the Monument's six fire and resource management objectives (see Chapter I: Purpose and Need)	#1 Life, property, resources	Would adequately meet fire and resource management objectives 1, 2, 4, 5, and 6. Would not meet objective 3.	Would effectively meet all fire and resource management objectives.
	#2 Suppression Impacts		
	#3 Fire Information Program		
	#4 Restore ecosystems		
	#5 Prescribed fire		
	#6 Natural fires		
Degree to which the alternative meets the purpose and need for action (see Chapter I: Purpose and Need)		Would satisfy the purpose for action, but not the need for action because this plan would not consider advances in fire science knowledge, new technologies and fire- fighting techniques, long-term solutions to new and current resource	Would satisfy the purpose and need of implementing a new and updated FMP that considers advances in fire science knowledge; new technologies and fire-fighting techniques; long- term solutions to new and current resource challenges; the most up to date

	Alternative 1: No Action	Alternative 2: Multiple Strategy
	challenges, the most current science- based research and monitoring, and new information about sensitive, threatened, or endangered species. It also would not take into account the changes that have occurred to Monument resources such as landscape- scale tree mortality due to drought conditions and beetle infestations.	science- based research and monitoring, new information about sensitive, threatened, or endangered species, and changes that have occurred to Monument resources since the 1997 FMP.
How alternative differs from Alternative 1: No Action	N/A	Clearly explains the definition and limited use of manual and mechanical thinning (mechanical thinning includes **only** low soil impact mechanical apparatus). Does not allow thinning in areas where wilderness suitability has not been determined. Emphasizes activities in the WUI. Identifies goals and objectives specifically addressing the WUI and defensible space. Requires the institution and maintenance of a comprehensive Fire Education and Information Program. Explains and emphasizes mitigations for natural, cultural, and physical resources. Includes a MOA with SHPO.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES: OVERALL IMPACTS BY TOPIC

Table 2.6 Summary of environmental consequences: overall impacts by topic
(Note: More in- depth analysis and definitions of the type, duration, and intensity of impacts for each impact topic can be found in Chapter 4.)

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
Vegetation	Impacts would be adverse, short- term, and minor to moderate. There would also be beneficial, short and long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.	Impacts would be adverse, short- term, and range from negligible to moderate. There would also be beneficial, short and long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.
Wildlife	For thinning activities, adverse impacts would be short- term and negligible. For prescribed fire and WFURB activities, adverse impacts would be short- term and negligible to minor. Adverse impacts from suppression activities would be short- term and negligible. For all activities, beneficial impact would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	For thinning activities, adverse impacts would be short- term and negligible. For prescribed fire and WFURB activities, adverse impacts would be short- term and negligible to minor. Adverse impacts from suppression activities would be short- term and negligible. Beneficial impacts for all activities would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Special Status Species: Wildlife		
Bald eagle	Implementation of the No Action Alternative would not adversely affect the bald eagle in the long- term. Adverse impacts from WFURB activities would be short- term and negligible to minor. Beneficial impacts would be long- term, and negligible to minor. Cumulative impacts would be long- term and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.	Implementation of Alternative 2 may affect, but would not adversely affect the bald eagle in the long- term. Adverse impacts from WFURB activities would be short- term and negligible to minor. Beneficial impacts would be long- term and minor. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
Mexican spotted owl	May affect but would not jeopardize the continued existence of the Mexican spotted owl. The impact would include both adverse, short- term, moderate impact and beneficial, long- term, minor to moderate impact. Cumulative impacts are anticipated to be beneficial and minor to moderate in the long- term.	May affect, but would not adversely affect the Mexican spotted owl in the long- term. Short- term adverse impact would be minor. Beneficial impact would be long- term and minor to moderate. Cumulative impact would be beneficial, long- term and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Northern goshawk	Adverse impacts are anticipated to be short- term and negligible to minor. Beneficial impacts are anticipated to be long- term and negligible to minor. Cumulative impacts are expected to be beneficial, long- term, and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.	Adverse impacts would be similar to Alternative 1: short- term and negligible to minor. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are expected to be beneficial, long- term, and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.
Goat Peak pika	Adverse impacts are anticipated to be adverse, short- term, and negligible. Beneficial impacts are anticipated to be long- term and negligible to minor. No cumulative impacts are anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1: adverse, short- term, negligible impacts and long- term, negligible to minor beneficial impacts. No cumulative impacts are anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Townsend's big- eared bat	Impacts would be adverse, short- term, negligible impacts. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1, short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
American peregrine falcon	Adverse impacts would be short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Adverse impacts would be similar to Alternative 1, short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
Spotted bat	Impacts would be adverse, short- term, negligible impacts. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1: adverse, short- term and negligible and beneficial, long- term, and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Jemez Mountains Salamander	Impacts would be adverse, short- term, and negligible to minor. Beneficial impacts would be long- term and minor to moderate. Cumulative impacts are not anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1: adverse, short- term, and negligible to minor and beneficial, long- term, and minor to moderate. Cumulative impacts are not anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Special Status Species: Plants		
Gramma grass cactus	Impacts would be beneficial and adverse, short- term, and negligible. Cumulative impacts would be adverse, short- term, and negligible to minor as well as beneficial, long- term, and minor.	Impacts would be beneficial and adverse, short- term, and negligible. Cumulative impacts would be adverse, short- term, and negligible as well as beneficial, long- term, and minor.
Yellow lady slipper	Impacts would be adverse, short- term, and minor to moderate. There would also be beneficial, long- term, minor to moderate impacts. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term. There would be no cumulative impacts.	Impacts would be adverse, short- term, and negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts. There would be no cumulative impacts.
Grape fern	Impacts would be adverse, short- term, and minor to moderate. There would also be beneficial, long- term, minor to moderate impacts. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term. There would be no cumulative impacts.	Impacts would be adverse, short- term, and negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts. There would be no cumulative impacts.
Wood lily	Impacts would be adverse, short- term, and minor to moderate. There would also be beneficial, long- term, minor to moderate impacts. While the intensity of adverse and beneficial impacts are	Impacts would be adverse, short- term, and negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. When comparing the adverse and beneficial impacts, the intensity and duration

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
	similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term. There would be no cumulative impacts.	of beneficial impacts are greater than the adverse impacts. There would be no cumulative impacts.
Soils and Water Resources	Impacts would be adverse, short- term, and range from negligible to moderate. There would also be beneficial, short and long- term, negligible to moderate impacts. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term. Cumulative impacts to soils would be adverse, short- term, and negligible to minor. Cumulative impacts to water resources would be adverse, short- term, and negligible. There would also be beneficial, long- term, minor to moderate cumulative impacts to soils and water resources.	Impacts would be adverse, short- term, and range from negligible to minor. There would also be beneficial, short and long- term, negligible to moderate impacts. Cumulative impacts to soils would be adverse, short- term, and negligible to minor. Cumulative impacts to water resources would be adverse, short- term, and negligible. There would also be beneficial, long- term, minor to moderate cumulative impacts to soils and water resources. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Air Quality	Impact from thinning activities would be adverse, short- term, localized, and negligible to minor. Fire activities would result in adverse, short- term, minor to moderate impacts. Cumulative impacts due to thinning activities would be adverse, short- term, and negligible to minor. Cumulative impacts due to fire activities would be adverse, short- term, and minor to moderate.	Impact from thinning activities would be adverse, short- term, localized, and negligible. Fire activities would result in adverse, short- term, minor to moderate impacts. Cumulative impacts due to thinning activities would be adverse, short- term, and negligible. Cumulative impacts due to fire activities would be adverse, short- term, and minor to moderate.
Archeological Resources	May result in adverse, long- term, negligible to minor impacts from manual and mechanical thinning. Prescribed fire, WFURB, and fire suppression activities would have an adverse long- term, minor impact on archeological resources. There would be no impact to flammable wooden artifacts or features. Beneficial impact for all activities are expected to be long- term and minor to moderate. Cumulative impacts are anticipated to be beneficial, minor to moderate, and long- term. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	May result in impacts similar to Alternative 1, adverse, long- term, and negligible to minor impacts from manual and mechanical thinning and adverse long- term, minor impact from prescribed fire, WFURB, and fire suppression activities. Beneficial impact for all activities are expected to be minor to moderate and long- term. Cumulative impacts are anticipated to be long- term, minor to moderate, and beneficial. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Ethnographic Resources	May have adverse, short to long- term, negligible to minor impacts and beneficial, long- term, minor to moderate impacts. Cumulative impacts are anticipated to be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1: adverse, short to long- term, negligible to minor impacts and beneficial, long- term, minor to moderate impacts. Cumulative impacts would be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
Cultural Landscape Resources	May result in adverse, long- term, negligible to minor impacts from manual and mechanical thinning. Prescribed fire and WFURB activities would have an adverse, long- term, minor impact. Fire suppression activities would have adverse, long- term, and negligible to minor impacts. Beneficial impacts for all activities would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be similar to Alternative 1: adverse, long- term and negligible to minor impacts from manual and mechanical thinning; adverse, long- term, and minor for prescribed fire and WFURB activities; and adverse, long- term, negligible to minor impact for fire suppression activities. Beneficial impacts from all activities would be long- term and minor to moderate. Cumulative impacts would be similar to Alternative 1: beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Historic Resources	May result in adverse, short- term, and negligible impacts from manual or mechanical thinning. Adverse impacts from prescribed fire and fire suppression would be long- term and minor. There would be no impact from WFURB. Beneficial impacts from thinning activities, prescribed fire, and fire suppression would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity of beneficial impacts is greater than the adverse impacts.	For manual and mechanical thinning, impacts would be similar to Alternative 1, adverse, short- term and negligible. For prescribed fire and fire suppression, impacts would be similar to Alternative 1: adverse, long- term, and minor. Beneficial impacts for manual and mechanical thinning, prescribed fire, and fire suppression would be long- term and minor to moderate. WFURB would have no impact. Cumulative impacts would be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity of beneficial impacts is greater than the adverse impacts.
Public Health and Safety	Impacts would be adverse, short- term, and range from negligible to moderate, as well as beneficial, long- term, and minor to moderate. Cumulative impacts would be adverse, short- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.	Impacts would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and minor to moderate. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.
Visitor Use and Experience	Impacts would be adverse, short and long- term, and range from negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.	Impacts would be adverse, short and long- term, and range from negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Impact Topic	Alternative 1: No Action	Alternative 2: Multiple Strategy
Special Designations: Wilderness	Manual thinning using hand tools would have adverse, short-term and negligible impacts. Beneficial impacts from manual thinning would be long- term and minor. Prescribed fire and WFURB activities would have adverse, short- term, negligible to minor impacts. Beneficial impacts would be long- term and moderate. Cumulative impacts would be adverse, short- term, and negligible to minor as well as beneficial, long- term, and moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts is greater than the adverse impacts.	Impacts would be similar to Alternative 1: for manual thinning using hand tools, adverse impacts would be short- term and negligible. Beneficial impacts would be long- term and minor. For prescribed fire and WFURB activities, impacts would be adverse, short- term, negligible to minor as well as beneficial, long- term, and moderate. Cumulative impacts would be adverse, short- term, and negligible to minor as well as beneficial, long- term, and moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts is greater than the adverse impacts.

Chapter 3
AFFECTED ENVIRONMENT

INTRODUCTION

The Council on Environmental Quality requires that NEPA documents "succinctly describe the environment of the area(s) to be affected or created by alternatives under consideration (1502.15)." Accordingly, this chapter describes the existing conditions of the biological, physical, cultural, and social resources that would be affected by the alternatives introduced in Chapter 2. It describes only those resources identified in Chapter 1 under Impact Topics Selected for Detailed Analysis. The effects of implementation of the alternatives are discussed in detail in Chapter 4: Environmental Consequences.

BIOLOGICAL ENVIRONMENT

This section details the existing conditions for vegetation (including invasive and non- native species), wildlife, and special status species.

VEGETATION

(See Appendix F for a description of historical landuse and vegetation resource impacts).

The vegetation community classification presented below was developed for management purposes to provide convenient and easily recognized groupings of major plant assemblages that occur at Bandelier. This classification is useful primarily at a landscape scale, therefore considerable variability may exist within the defined types. An overview of the vegetation communities at Bandelier and their relative distribution can be seen on the accompanying vegetation maps of Bandelier: Main Unit (Figure 3.1) and Tsankawi Unit (Figure 3.2).

Figure 3.1 Vegetation Communities in Bandelier National Monument

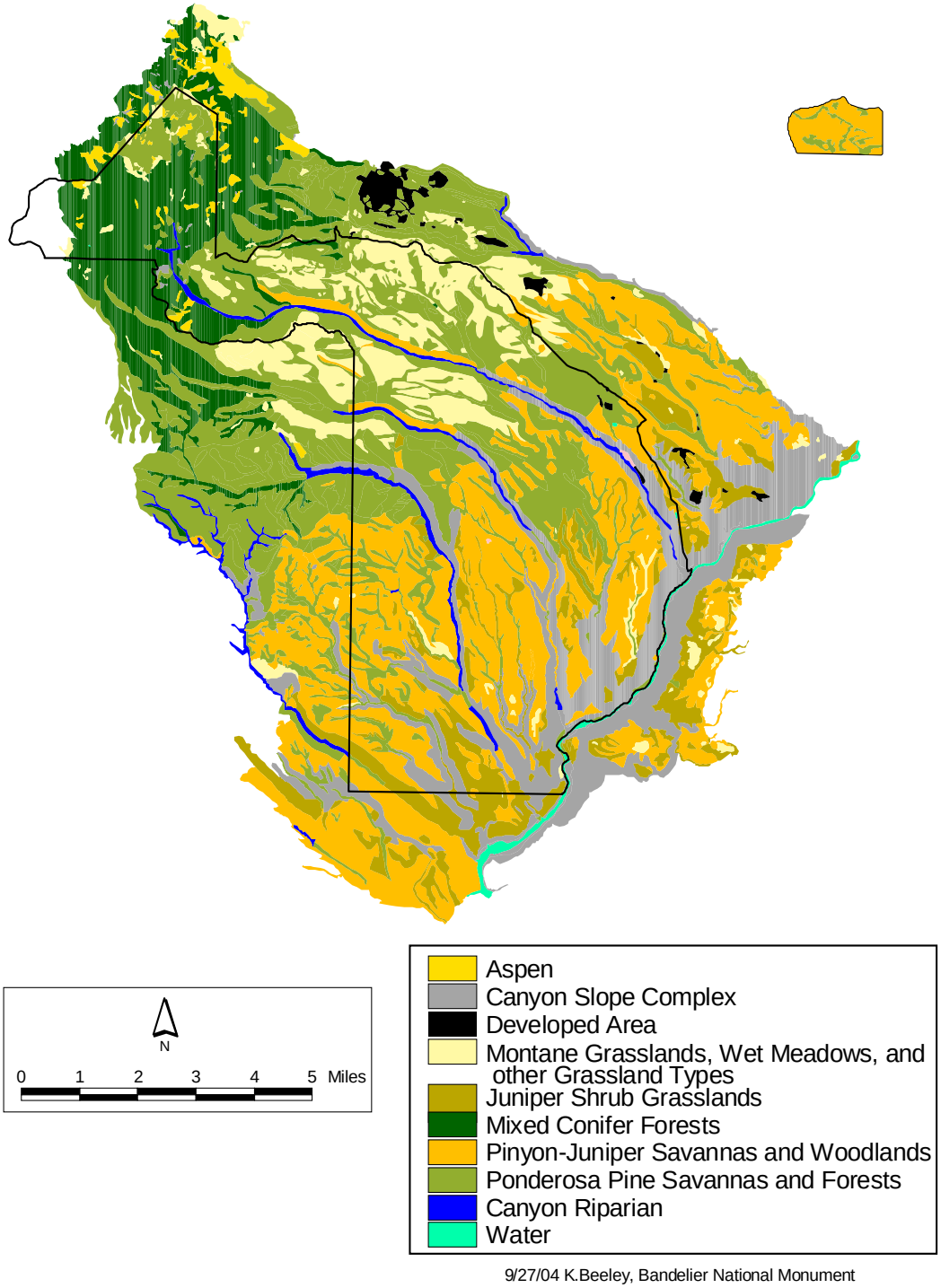
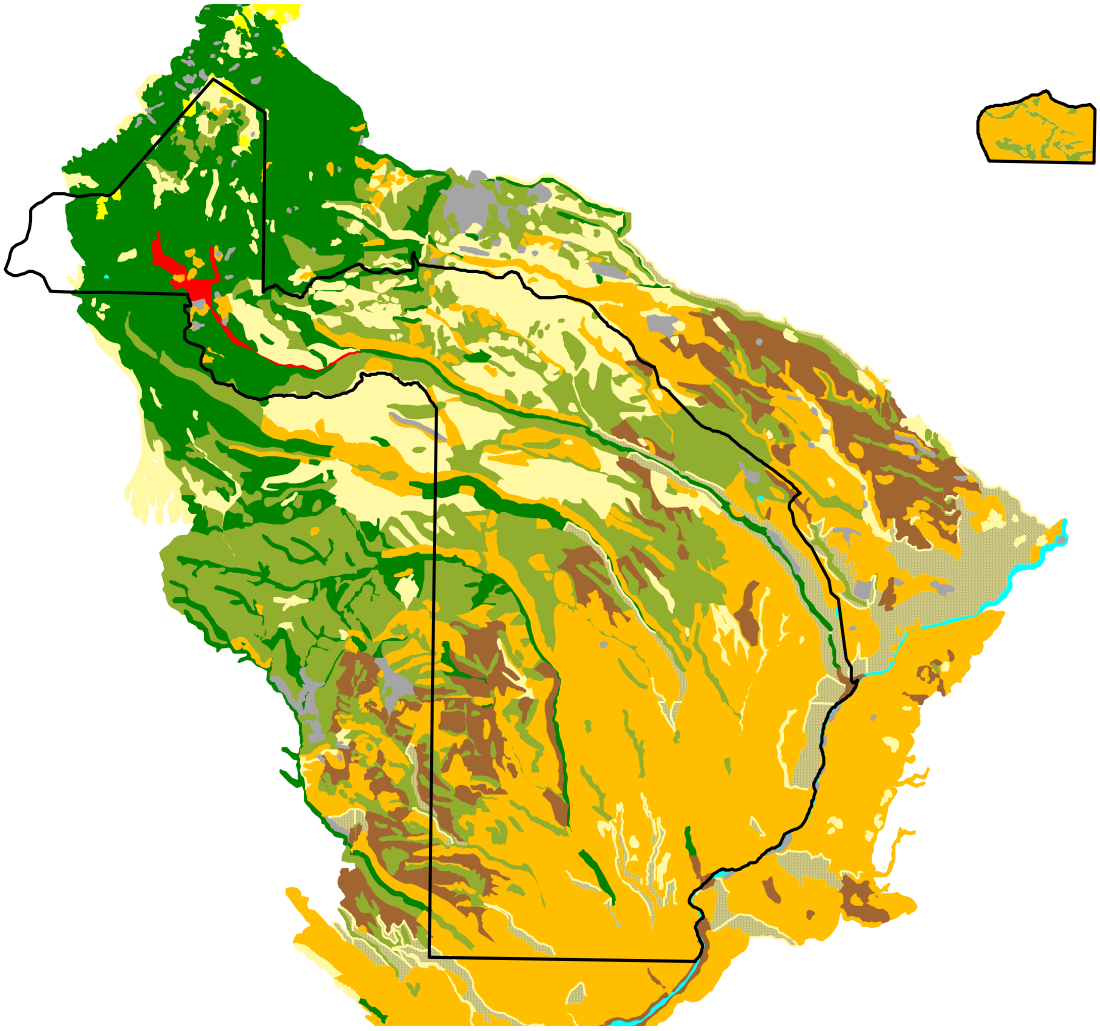


Figure 3.2 Vegetation Communities in Tsankawi Unit, Bandelier National Monument

9/27/04 K.Beeley, Bandelier National Monument

Figure 3.3 Fire Behavior Fuel Models in Bandelier National Monument



A general elevational sequence of the major vegetation cover types within Bandelier from the eastern boundary of the Monument along the Rio Grande at 5,300 ft to the summit of Cerro Grande at 10,200 ft would proceed as follows: juniper- shrub grasslands occur from 5,300 ft to approximately 6,200 ft; pinyon- juniper woodlands from 6,200 to 7,000 ft; ponderosa pine forests 7,000 to 7,500 ft; and mixed conifer forests consisting of ponderosa pine, Douglas fir, white fir, Engelmann spruce, blue spruce, aspen, and limber pine from 7,500 to 10,200 ft. Grassland, shrub, and aspen types are found on southerly exposures within the mixed conifer zone. Detailed descriptions of vegetation communities are below.

Also included under each vegetation community classification is a description of the fire behavior fuel model (see figure 3.3 for a map of Bandelier's fuel models). These mathematical fire behavior fuel models were developed by Rothermel (1972) and Albini (1976) to provide a quantitative basis for rating fire danger and predicting fire behavior. This can be valuable in fire control efforts and when assessing potential damage to resources. There are thirteen different models that provide a description of fuel properties, such as the fuel load, fuel bed depth, and moisture extinction of dead fuels (the moisture at which fire will not spread) that are typical of a particular fuel complex (vegetation community). These fuel characteristics, which differ between vegetation communities, are then used to estimate the potential fire behavior (Anderson, 1982). The National Fire Danger Rating System (NFDRS) values are also noted for each fire behavior fuel model.

Juniper- shrub grasslands:

Characterized by the presence of a one- seed juniper overstory (frequently occurring as a result of tree invasion since 1880) with an understory of various shrubs, grasses and forbs. Typical shrubs may include wavyleaf oak, mountain mahogany, skunk bush, apache plume, rabbit brush, and big sagebrush. This type is found on the lower mesas and canyon slopes and on elevated benches along the Rio Grande corridor. In addition to relict juniper savanna communities, this type incorporates former shrub and grassland communities recently invaded by juniper as a result of historic grazing and loss of fire regime.

Fire behavior fuel model:

The juniper- shrub grasslands are a fire behavior fuel model 5. This correlates with the NFDRS model D. Fire is generally carried in the surface fuels (litter, grasses, and forbs) and is typically not very intense because surface fuels are light and sparse. Table 3.1 lists the fuel model values for estimating fire behavior for model 5.

Table 3.1 Fuel model values for estimating fire behavior, model 5

Total fuel load of dead and live materials < 3 inch	3.5 tons/acre
Dead fuel load of materials .25 inch	1.0 tons/acre
Live fuel load (foliage)	2.0 tons/acre
Fuel bed depth	2.0 feet
Moisture of extinction (dead fuels)	20%

Pinyon- juniper savannas and woodlands:

Generally characterized by overstory dominance of Colorado pinyon pine and/ or one-seed juniper overstory with a potentially diverse shrub, grass and forb understory. Dominant shrubs include wavyleaf oak and mountain mahogany. This community is located elevationally between the juniper- shrub grasslands and ponderosa pine types and is distinguished from the former by increased tree canopy cover and presence of pinyon pine. Embedded within this type are at least two distinct entities: older growth woodlands on rocky, shallow soil sites and recently invaded savanna communities on deeper, more productive soil sites. Since the 1950's, pinyon and juniper have expanded their ranges upslope into the ponderosa community while juniper has invaded downslope into former grassland and shrub dominated communities; density of trees has increased dramatically throughout. These changes are thought to be a result of historic grazing and loss of fire regime since 1880 (Allen, 1989). Alligator juniper becomes an important component of woodlands on steep rocky slopes in the southern portion of the Monument.

Fire behavior fuel model:

The pinyon- juniper savannas and woodlands are a fire behavior fuel model 6. This correlates with the NFDRS models F and Q. Fire carries through the shrub layer, requiring moderate winds (> 15 to 20 mi/hr at 20 ft. level). Fire will drop to the ground at low wind speeds or at openings in the stand. Table 3.2 lists the fuel model values for estimating fire behavior for model 6.

Table 3.2 Fuel model values for estimating fire behavior, model 6

Total fuel load of dead and live materials < 3 inch	6.0 tons/acre
Dead fuel load of materials .25 inch	1.5 tons/acre
Live fuel load (foliage)	0 tons/acre
Fuel bed depth	2.5 feet
Moisture of extinction (dead fuels)	25%

Ponderosa pine savannas and forests:

Dominated by a mature ponderosa pine overstory (from open savanna structure to closed canopy) with a variety of grass- forb, shrub, and tree understories depending on elevation and aspect as well as recent fire history. Fire suppression and overgrazing in ponderosa pine forests have resulted in increasing both stand densities of ponderosa as well as recruitment of pinyon- juniper (upslope) and mixed conifer (downslope). Areas recently altered by catastrophic crown fire (i.e. La Mesa and Dome fire areas) are included under other grassland types since they are currently lacking the characteristic mature ponderosa pine overstory.

Fire behavior fuel model:
The ponderosa pine savannas and forests are a fire behavior fuel model 9. This correlates with the NFDRS model E, P, U. Fire carries through the surface litter at slow to moderate speeds. Concentrations of dead and down woody materials contribute to the torching of trees, spotting, and possibly crowning. Table 3.3 lists the fuel model values for estimating fire behavior for model 9.

Table 3.3 Fuel model values for estimating fire behavior, model 9

Total fuel load of dead and live materials < 3 inch	3.5 tons/acre
Dead fuel load of materials .25 inch	2.9 tons/acre
Live fuel load (foliage)	0 tons/acre
Fuel bed depth	.2 feet
Moisture of extinction (dead fuels)	25%

Mixed conifer forests:

Mixed conifer forests, occurring on mountain slopes and within upper canyon drainages, are characterized by a mixed overstory of mostly coniferous species (i.e. dominated by Douglas fir with subdominants being ponderosa pine, white fir, aspen, Engelman spruce, and limber pine. Blue spruce is common in mesic meadow situations where it may form nearly pure stands. Douglas fir is common throughout with ponderosa pine becoming dominant on dry mountain slopes and ridges. In the absence of fire, aspen clones can become over topped by coniferous species and grazing pressures can accelerate conversion of aspen to mixed conifer type through the combined effects of browsing on aspen saplings and consumption of fine fuels. At high elevations on northern exposures (primarily outside Monument boundaries), Engelman spruce and corkbark fir become important components of the mixed conifer type. Absence of fire from this type, as a result of fire suppression activities, has resulted in increased densities of the more shade tolerant trees in the understory, reduced herbaceous and shrub cover, and heavy fuel loading. Within this type are two sub- components distinguished by stand structure and species composition and a function of location and fire regime.

The common and widespread sub- component is distinguished by uneven stand structure with older growth, open stand structure, and an herbaceous/ shrub understory maintained by fire return intervals less than 15 years. The second sub- component is more limited in extent; it is distinguished by a uniform, even- aged stand structure which is maintained by episodic crown fire return intervals (>100 years) and is often localized to steep, upper elevation, canyon systems, or north facing slopes. The cool, moist conditions in these settings and associated species composition that produces compact ground litter, precludes surface fire in most years. Even aged structure is reflective of episodic mortality and establishment following fire events.

Fire behavior fuel model:
The mixed conifer forests are a fire behavior fuel model 10. This correlates with the NFDRS model G. Fires burn in the surface litter and ground fuels with moderate to high intensity and speed. There is generally a large amount of dead and down fuel greater than 3

inches in diameter present on the forest floor. Crowning, spotting, and torching of individual trees are more frequent in this fuel type. Table 3.4 lists the fuel model values for estimating fire behavior for model 10.

Table 3.4 Fuel model values for estimating fire behavior, model 10

Total fuel load of dead and live materials < 3 inch	12.0 tons/acre
Dead fuel load of materials .25 inch	3.0 tons/acre
Live fuel load (foliage)	2.0 tons/acre
Fuel bed depth	1.0 feet
Moisture of extinction (dead fuels)	25%

Aspen groves:

These communities are dominated by an overstory of aspen (often to the exclusion of other species) with an understory of grasses and forbs. It is considered a potentially long-lived, but fire dependent seral stage which colonizes 'holes' created in mixed coniferous forests created by crown fire. These aspen clones will yield dominance to mixed conifer establishment in the absence of periodic fire.

Fire behavior fuel model:

The aspen groves are a fire behavior fuel model 8. This correlates with the NFDRS model H and R. Fire generally moves slowly through the surface layer with short flame lengths, although occasional heavy fuel concentrations may occur which cause the fire to flare up. Table 3.5 lists the fuel model values for estimating fire behavior for model 8.

Table 3.5 Fuel model values for estimating fire behavior, model 8

Total fuel load of dead and live materials < 3 inch	5.0 tons/acre
Dead fuel load of materials .25 inch	1.5 tons/acre
Live fuel load (foliage)	0 tons/acre
Fuel bed depth	.2 feet
Moisture of extinction (dead fuels)	30%

Montane grasslands, wet meadows, and other grassland types:

This assemblage includes several grass dominated communities currently distributed as localized patches and becoming embedded within the mixed coniferous type through progressive tree invasion due to the absence of fire. Montane grasslands are grass and forb dominated openings within mixed conifer or aspen forests on southerly exposures of upper mountain slopes. Occasionally intermingled with montane meadows are rock fields (felsenmeers) which can support patchy shrub and forb growth where soils have accumulated. Wet meadow areas are similarly situated grassy openings within mixed conifer forests, but located at the low gradient base of mountain slopes where snow runoff accumulates in late spring. Other montane grasslands include those grassy areas of more recent origin which may exist as a result of recent crown fire or mechanical clearing. All of these grasslands are interspersed with or bounded by stands of mixed conifer and aspen and can be considered a fire dependent seral stage since they will yield to mixed conifer establishment in the absence of fire. Patches of shrub (i.e. gambel oak and mountain spray)

and scattered coniferous trees are often present in all types. In addition to active fire suppression, some of these grassland areas (i.e. wet meadows) have been subject to intensive overgrazing which has facilitated the establishment of exotic perennial grasses and forbs (i.e. white clover, dandelion, and Kentucky blue grass). Other grassland types include former ponderosa pine forests converted to grass and shrub (gambel oak and New Mexico locust) dominated systems by recent catastrophic crown fire; recovery of these areas to ponderosa pine forest is not anticipated for up to several hundred years.

Fire behavior fuel model:
The montane grasslands, wet meadows, and other grassland types are a fire behavior fuel model 1. This correlates with the NFDRS models A, L, and S. Fire moves through cured grasses and associated materials at rapid speeds. Table 3.6 lists the fuel model values for estimating fire behavior for model 1.

Table 3.6 Fuel model values for estimating fire behavior, model 1

Total fuel load of dead and live materials < 3 inch	.74 tons/acre
Dead fuel load of materials .25 inch	.74 tons/acre
Live fuel load (foliage)	0 tons/acre
Fuel bed depth	1 feet
Moisture of extinction (dead fuels)	12%

Canyon slope complex:
This complex resembles the vegetation type on adjacent mesas and mountain slopes, but with additional floristic elements favoring steep, rocky or extreme north/south exposures as well. Reference should be made to the dominant overstory vegetation (i.e. pinyon-juniper, ponderosa pine, and mixed coniferous canyon slope complex). Within the upper elevation mixed coniferous type, the canyon slope community is not distinguishable from the adjacent mountain slope and mesatop communities. At lower elevations, the canyon slope complex becomes more distinct from the adjacent mesatop vegetation types (i.e. lower elevation ponderosa and pinyon- juniper woodlands) and relative to these has lower densities of trees, higher densities of shrubs, and a more robust grass cover. Typical shrubs on lower elevation canyon slopes may include wavyleaf oak, mountain mahogany, mock orange, and mountain spray. Predominance of junipers less than several hundred years in age on the lower canyon slopes may suggest either grazing pressures interrupted fire regimes by consuming fire fuels or severe drought truncated age structure. The often rocky substrate of canyon slopes afford enhanced stability to plants established in favorable microsites and steep slopes have limited the potential for grazing. Intense fire runs have converted portions of formerly forested canyon slopes (at all elevations) into shrub communities. Fire frequencies on canyon slopes have not been well documented but could be expected to be within the low end of ranges reported for adjacent communities given adequate continuity of fuels. In areas with poor fuel continuity typical of rocky substrate areas, fire occurrence was undoubtedly much less frequent than in adjacent communities.

Fire behavior fuel model:

This complex would most likely have a fire behavior fuel model of 4 or 6. This correlates with the NFDRS models B and O, or F and Q, respectively. However, because this complex can resemble the vegetation type on adjacent mesas and mountain slopes, reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa, or mixed conifer) when determining the fire behavior fuel model.

Canyon riparian:

This complex is a narrow riparian zone which includes dominant overstory elements from vegetation types immediately upslope and those additional floristic elements requiring enhanced moisture regimes. Reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa, or mixed conifer canyon bottom complex). Some common species associated with this riparian zone include: narrowleaf cottonwood, boxelder, mountain maple, birch, alder, gambel oak, cherry and New Mexico olive. Most of Bandelier's sensitive plants are associated with perennial moisture found in the upper canyons areas. Periodic beaver dam activity within this zone has left notable impacts in the form of abandoned dams and associated pond terraces (upper canyon) and mortality through cutting of numerous large diameter cottonwoods (lower canyon). This is a fairly intact community in most areas where the historic use was limited to seasonal grazing. Areas developed for more intensive uses (i.e. agriculture, housing, and visitor use) such as Frijoles Canyon between Long House and the stable can be dominated by exotic perennial grasses or invasive native shrubs. Fire regimes for canyon bottom areas are comparable to the adjacent community.

Fire behavior fuel model:

The fire behavior fuel model that corresponds most closely with the narrow riparian component of this vegetation type is a fuel model 8, which could carry into a model 4 or 6. When considering areas that are adjacent to or more upslope from the narrow riparian zone, reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa, or mixed conifer).

Invasive non- native plants

Non- native plants (i.e. exotic, introduced, or alien species) constitute about 17 percent of the vascular plant species occurring in Bandelier. Disturbances associated with homesteading, historic overgrazing, loss of fire regime, and post- wildfire rehabilitation facilitated the widespread establishment of non- native species in Bandelier. Losses of soil and herbaceous vegetation along with continued grazing pressures from feral and native ungulates have hampered recovery of native flora. While some non- native plant species are likely to become naturalized components of the local flora, many more are aggressive invaders of native plant communities. Monument management seeks to minimize the impacts of these invasives and contain their spread, but complete eradication is in most instances impractical. The Bandelier Draft Vegetation Management Plan (NPS, 2002) indicates that woody species such as salt cedar, Siberian elm, Russian olive, and tree of heaven should be removed. Herbaceous and grass species with more extensive distributions include kochia, Russian thistle, whitetop, Canada thistle, musk thistle, yellow toadflax, perennial pepperweed, burdock, mullein, cheat grass, and dandelion. These species are not specifically addressed as part of this FMP, except as part of landscape scale restoration efforts.

WILDLIFE

Bandelier supports a wide variety of wildlife species, including approximately 1000 known arthropods, 5 amphibians, 14 reptiles, and 44 mammals (including 5 species of bats). In addition, about 115 bird species and 90 species of ants have been recorded in and around the Monument (Allen, 1989).

Wildlife presence and habitat use are closely associated with vegetation types and elevation gradients. Mammals common in the Monument include mule deer, elk, striped skunk, porcupine, and many small rodent species. Black bears and mountain lions are present in the Monument, but in very low numbers. Birds such as the mourning dove, white-throated swift, broad- tailed hummingbird, northern flicker, gray flycatcher, Cassin's kingbird, plumbeous vireo, Stellar's joy, western scrub jay, common raven, western bluebird, American robin, Grace's warbler, western tanager, and black- headed grosbeak are widespread throughout the Monument. Reptiles and amphibians likely to be present in Bandelier include western diamondback rattlesnake, eastern fence lizard, tree lizard, collared lizard, canyon treefrog, tiger salamander, and striped chorus frog (Cook et al., 2000). Table 3.7 in Appendix G provides a list of selected species by vegetation zone that are present within Bandelier. Special status wildlife species, including those listed as federally threatened or endangered are discussed below.

SPECIAL STATUS SPECIES (PLANTS AND WILDLIFE)

This section presents special status species that may be found in the Monument. Special status species include: 1) species federally listed as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA); 2) species that are proposed or are candidates for listing under ESA or federal species of concern that are not protected pursuant to ESA but are monitored for conservation status; and 3) State of New Mexico listed threatened or endangered species and special status plant species.

Table 3- 8 lists federal and state listed threatened, endangered, proposed, and candidate species and species of concern that may occur within Los Alamos, Santa Fe, and Sandoval counties. This list was created using information obtained from the U.S. Fish and Wildlife Service (USFWS) for Los Alamos, Santa Fe, and Sandoval counties, New Mexico on May 27, 2004 (USFWS, 2004a) and the New Mexico Natural Heritage Program Biological and Conservation Data System (NMNHP, 2004). Table 3- 8 lists the potential for occurrence within Bandelier based on species habitat association, life history, and historical documented occurrences. Only those species with a likely potential for occurrence are evaluated further in this document.

Table 3.8 Special status species that may occur in Los Alamos, Santa Fe, and Sandoval counties.

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Potential for Occurrence in Bandelier[3]
American peregrine falcon	*Falco peregrinus anatum*		T	Likely
Arctic peregrine falcon	*Falco peregrinus tundrius*	SC		Unlikely
Baird's sparrow	*Ammodramus bairdii*	SC	T	Unlikely
Bald Eagle	*Haliaeetus leucocephalis*	LE (partial status)	T	Likely
Gray vireo	*Vireo vicinior*		T	Unlikely
Mexican spotted owl	*Strix occidentalis lucida*	LT		Likely
Mountain plover	*Charadrius montanus*	SC		Unlikely
Northern goshawk	*Accipter gentiles*	SC		Likely
Southwestern willow flycatcher	*Empidonax traillii extimus*	LE		Unlikely
Western burrowing owl	*Athene cunicularia hypugea*	SC		Unlikely
Whooping crane	*Grus americana*	LE		Unlikely
Yellow- billed cuckoo	*Coccyzus americanus*	C		Unlikely
Black footed ferret	*Mustela nigripes*	E		Unlikely
Goat peak pika	*Ochotona princes nigrescens*	SC		Likely
New Mexican meadow jumping mouse	*Zapus hudsonius lutues*		T	Unlikely
Spotted bat	*Euderma maculatum*		T	Likely
Townsend's big-eared bat	*Corynorhinus townsendii*	SC		Likely
Jemez Mountains salamander	*Plethodon neomexicanus*		E	Likely
New Mexico silverspot butterfly	*Speyeria nokomis nitocris*	SC		Unlikely
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	SC		Unlikely
Rio Grande silvery minnow	*Hybognathus amarus*	LE	E	Unlikely
Rio Grande sucker	*Catostomus plebeius*	SC		Unlikely
San Ysidro tiger beetle	*Cicindela willistoni funaroi*	SC		Unlikely
William Lar's tiger beetle	*Cicindela fulgida williamslarsi*	SC		Unlikely
Grama grass cactus	*Toumeya papyracantha*		D	Likely
	Townsendia	SC		Unlikely

Gypsum townsendia	***gypsophila***			
Gypsum phacelia	***Phacelia* sp. nov.**	**SC**		**Unlikely**
Knight's milk- vetch	***Astragalus knightii***	**SC**		**Unlikely**
Mountain (wood) lily	***Lilium philadelphicum* var. *andinum***		**E**	**Likely**
Parish's alkali grass	***Puccinellia parishii***	**SC**		**Unlikely**
Yellow lady's slipper	***Cypripedium parviflorum* var. *pubescens***		**E**	**Likely**
Santa Fe cholla	***Optunia viridiflora***	**SC**		**Unlikely**
Cerro hawthorn	***Crataegus erythropoda***		**D**	**Likely**

[1] Federal status under the ESA: LE = Endangered; LT = Threatened; C = Candidate for listing; SC = Species of Concern.

[2] State status: E = Endangered; T= Threatened; D = Taxa considered, but not included on above lists or was delisted from above lists.

[3] Potential for occurrence includes both resident and migratory.

Threatened and Endangered Species and Federal Species of Concern

Of the federally listed or candidate species presented in Table 3- 8, only the bald eagle and Mexican spotted owl are likely to occur within Bandelier National Monument. Federal species of concern that are likely to occur in Bandelier are also included in this section. There are no proposed or candidate species that are likely to occur in the Monument.

Threatened and Endangered Species

Bald eagle

Bald Eagles inhabit coastal areas, estuaries, unfrozen inland waters, and some arid areas of the western interior and southwestern portion of the U.S. (NMDGF, 2004a). They prefer areas with high water- to- land edge, and areas with unimpeded views including both horizontal and vertical aspects. Areas selected for wintering habitat have an adequate food supply with access to open water such as river rapids, impoundments, dam spillways, lakes, and estuaries. Communal roosts are generally comprised of several individuals and are common in the winter months in areas that provide protection from adverse weather conditions. (NMDGF, 2004a).

Bald eagles are winter migrants in the area and are known to roost in main canyon mouths along the Rio Grande. Suitable habitat for this species includes lowland riparian habitats with adjacent large diameter snags, conifer tree species, and cliffs available for roosting.

Mexican spotted owl

Mexican spotted owls nest, roost, and forage in a diverse assemblage of vegetation communities. Mixed- conifer forests are commonly used throughout most of the range

(USFWS, 1995). In general, these communities are dominated by Douglas- fir and/or white fir, with co- dominant species including southwestern white pine, limber pine, and ponderosa pine (Brown et al., 1980). In addition to these species, the understory often contains broadleaved species such as Gambel oak, maples, boxelder, and New Mexico locust (USFWS, 1995).

Three classes of habitat have been recognized for Mexican spotted owls: nesting, roosting, and foraging. Nesting habitat typically consists of closed- canopy forests or rocky canyons (USFWS 1995, 2004b). Forests preferred by nesting spotted owls often contain mature or old- growth stands with complex structure and are typically uneven- aged, multi- storied, and have high canopy closure (USFWS, 1995). In the northern range of this species (including southern Utah, southern Colorado, and far northern Arizona and New Mexico), owls may nest in caves or on cliff ledges in steep walled canyons that provide situations for cool microsites (USFWS 1995, 2004b). For roosting, spotted owls will utilize small and large trees, scattered across the landscape; but they still maintain a preference for closed- canopy forest conditions. Spotted owls generally use a wider variety of forest conditions for foraging. Little is known about the pattern of use by foraging owls, but the habitat appears to be primarily defined by proximity to nesting or roosting habitat and its ability to provide vulnerable prey (USFWS, 1995).

Major canyons within Bandelier are thought to have suitable nesting and/or roosting habitat for the Mexican spotted owl. As such, Bandelier has established two spotted owl management area designations, Suitable Nesting Areas (SNAs) and Nesting/Roosting Zones (NRZs). Areas where conditions are known to favor nesting spotted owls, as described above, are called SNAs. These areas include all known historic spotted owl nests and regular roost areas, plus other areas that are known to have similar habitat characteristics, such as cliff areas and forest stands that exhibit the physical characteristics as described above. The NRZs contain all nesting habitat and nearly all roosting habitat, but may also contain areas that are not suitable nesting or roosting habitat. The NRZ also includes foraging habitat.

The USFWS published the Final Rule for Final Designation of Critical Habitat for the Mexican spotted owl on August 31, 2004 (69 FR 53182). Sections of Bandelier have been included in this critical habitat designation, including mixed conifer communities in canyons and steep slopes up to 9,000 ft.

Current spotted owl habitat management under the Fire Management Program is guided by the 1997 FMP and the *Biological Opinion on the Effects of Bandelier National Monument's Fire Management Program on the Mexican Spotted Owl*, issued by the U.S. Fish and Wildlife Service in 1998 (USFWS, 1998).

Federal Species of Concern

Northern goshawk
The northern goshawk is a raptor species that inhabits mid to high elevation (6,000 ft – 10,000 ft) ponderosa pine and mixed conifer forests (Graham et al., 1999). Nesting sites are generally located in mature to old growth forests with relatively large trees, high canopy

closure, sparse ground cover, and open understories (Graham et al., 1999). Areas typically used for foraging include closed canopy forests with moderate tree densities. Goshawks prey primarily on medium to large sized birds and mammals (Squires and Reynolds, 1997). There are documented occurrences of goshawks in ponderosa pine and mixed conifer forests above 7,000 ft in Bandelier.

Goat Peak pika
This small mammal is endemic to the Jemez Mountains and has a very limited range, found only in high elevations near 10,000 ft. It has been documented in Bandelier and is associated with montane grasslands and boulder fields (felsenmeers).

Townsend's big eared bat
This bat species uses caves for day roosts and hibernacula and will also use crevices on rock cliffs for refuge (NMDGF 2004b). In Bandelier, this species can be found between 5,500 and 8,500 ft.

State Listed Species

There are nine species with State of New Mexico designated special status (not including those with both state and federal listings, as shown in Table 3- 8). Of these species, peregrine falcon, spotted bat, Jemez Mountains salamander, and grama grass cactus, mountain lily, yellow lady's slipper, and Cerro hawthorn may be present within Bandelier.

American peregrine falcon
Peregrine falcons are known to utilize cliffs for nesting and prefer canyons that contain mixed conifer, ponderosa pine, bristlecone/limber pine, and pinyon/juniper communities for foraging. In New Mexico, the breeding territories of peregrine falcons center on cliffs that are in wooded/forested habitats, with large "gulfs" of air nearby in which these predators can forage (Hubbard, 1985).

There is suitable peregrine falcon habitat within Bandelier National Monument. The preferred breeding habitat is characterized by narrow canyons cut through volcanic tuff. Suitable foraging areas are located from White Rock Canyon to Cochiti Lake to the upper slopes of the Valle Caldera rim. Vegetation is primarily pinyon/juniper woodlands, ponderosa pine forests, and, mixed conifer forests which extend from the higher elevations down into the canyons. (Johnson, 1994). The *Bandelier National Monument Peregrine Falcon Habitat Management Plan* (Johnson, 1994) details the types of activities that could occur within and adjacent to suitable habitat.

Spotted bat
This species is a cliff dweller that roosts in cracks and crevices in cliffs and canyons (NMGFD, 2004c). In the Jemez Mountains, the spotted bat has been observed in ponderosa pine and mixed conifer forests adjacent to streams or water holes. They are thought to use habitats seasonally, utilizing ponderosa pine forests during breeding season (March - July) and moving to lower elevation woodlands at other times of the year (NMGFD, 2004c).

Jemez Mountains Salamander
In Bandelier, this species utilizes mixed conifer and ponderosa pine forests above 8,000 feet. It prefers areas with relatively high humidity and soils with a specific rock structure (NMGFD, 2004d). Typically, it will spend much of its time below the surface, under rocks and fallen logs, but will surface during the wettest part of the summer for short periods of time.

Grama Grass Cactus
The grama grass cactus is usually found in close proximity to canyon rims, in relatively open and grassy pinyon/juniper woodlands of gentle slope. In 1989, hundreds of individuals were transplanted into the Monument's detached Tsankawi unit. By 1993 only six individuals remained, and in 1994 a systematic survey found no surviving individuals. Suitable habitat for this species does remain in Bandelier although no individuals have been documented since 1993.

Mountain Lily
This plant can be found in the Jemez Mountains and typically ranges from 7,000 – 8,000 ft in elevation. Within Bandelier, this species may be found in upper Frijoles Canyon.

Yellow Lady's Slipper
This species prefers relatively open and grassy mixed conifer forests of mesic canyon bottoms. It has been documented in both the Jemez and Sangre de Cristo Mountains.

Cerro Hawthorn
This member of the rose family can be found from 7,000 – 8,000 ft in elevation in the Jemez Mountains. Within Bandelier, it may occur in upper Frijoles Canyon.

PHYSICAL ENVIRONMENT

This section details the existing conditions for soils and water resources and air quality.

SOILS AND WATER RESOURCES

Soil scientists have determined that there are about 42 different kinds of soils in the Bandelier area (USDA NRCS, 2000). The soils vary widely in their texture, color, natural drainage, slope, and other characteristics. The soils in the eastern and southern portions of the Monument are at low elevations. These soils are gently to steeply sloping and support juniper or pinyon/juniper woodland with the exception of the riparian areas along the perennial/semi- perennial streams and along the Rio Grande, which support a variety of deciduous/evergreen trees that often form a closed canopy. The soils in the northwestern portion of the Monument are at higher elevations and are generally steeply sloping and high in rock fragments. These soils occur in climates with enough soil moisture to foster the growth of woodland and montane forest plant communities, including montane grassland. Common soil parent materials in the Jemez Mountains (including Bandelier) range from rhyolites and andesites, with some dacites at high elevations, to tuff and pumice on the plateaus and basalts near the Rio Grande. Eolian dust has also been an important factor in local soil development. Patches of pumiceous soils are also prominent in Bandelier. Soil orders found in and near Bandelier include Entisols, Inceptisols, Alfisols, Mollisols, and Aridisols (USDA NRCS, 2000).

The deep erosional canyons that characterize Bandelier were formed by streams. These canyons from north to south are: Frijoles, Lummis, Alamo, Hondo, Capulin, Medio, and Sanchez (Figure 1.3). Frijoles creek flows through Frijoles Canyon and is currently the only stream that flows year- round from its headwaters to the Rio Grande. Semi-perennial streams flow through Alamo and Capulin canyons. These streams are perennial in the upper part but dry up in the lower part during the dry part of the year. All of the streams in Bandelier are primarily supported by the deep infiltration of precipitation received at higher elevations and snowmelt runoff (USDA NRCS, 2000). The only other perennial water sources in the Bandelier area are a number of springs, such as Apache, American, Turkey, lower Alamo, and lower Frijoles, although both lower Alamo and lower Frijoles springs are now covered by sediment (USDA NRCS, 2000).

AIR QUALITY

Health and Welfare

National Ambient Air Quality Standards (NAAQS) for criteria pollutants are intended to protect human health and general welfare. The criteria pollutants are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), particulate matter, lead, and carbon monoxide (CO). Violation standards for these pollutants are defined in Table 3.9 below.

Table 3.9 National Ambient Air Quality Standards (NAAQS).

POLLUTANT	STANDARD VALUE *		STANDARD TYPE
Carbon Monoxide (CO)			
8- hour Average	9 ppm	(10 mg/m^3)	Primary
1- hour Average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 g/m^3)	Primary & Secondary
Ozone (O_3)			
1- hour Average	0.12 ppm	(235 g/m^3)	Primary & Secondary
8- hour Average	0.08 ppm	(157 g/m^3)	Primary & Secondary
Lead (Pb)			
Quarterly Average	1.5 g/m^3		Primary & Secondary
Particulate (PM 10) *Particles with diameters of 10 micrometers or less*			
Annual Arithmetic Mean	50 g/m^3		Primary & Secondary
24- hour Average	150 g/m^3		Primary & Secondary
Particulate (PM 2.5) *Particles with diameters of 2.5 micrometers or less*			
Annual Arithmetic Mean	15 g/m^3		Primary & Secondary
24- hour Average	65 g/m^3		Primary & Secondary

Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.03 ppm	(80 g/m^3)	Primary
24- hour Average	0.14 ppm	(365 g/m^3)	Primary
3- hour Average	0.50 ppm	(1300 g/m^3)	Secondary

* Parenthetical value is an approximately equivalent concentration.

Monitoring is conducted nationwide by a variety of agencies to determine which areas comply with these primarily health- based standards. Although compliance data has not routinely been collected at Bandelier National Monument, the State of New Mexico has conducted sampling for some of the pollutants in nearby cities and towns about 30 miles downslope of the Monument. A summary is included in Table 3.10 below and it indicates compliance with the standards based on the three most recent years of data. For ozone, the comparison between Bandelier and populated areas lower in the valley is apt since ozone is frequently transported to higher elevations some distance away from its source area. Mobile sources in urban areas are substantial sources of ozone precursors.

Table 3.10 Ozone Monitoring data in parts per billion (ppb) for last three full calendar years.

EPA Air Quality Standard
120 ppb = 1- hour
80 ppb = 8- hour

Bernalillo NM site (approx. 35 miles from park near Albuquerque NM)

---------- 1- hour averages ----------						# Exceedences
1st Max	2nd Max	3rd Max	4th Max	Actual	Est.	Year
90	89	85	85	0	0	2003
87	84	82	91	0	0	2002
91	88	86	85	0	0	2001

---------- 8- hour averages ----------						# Exceedences
1st Max	2nd Max	3rd Max	4th Max	Actual	Est.	Year
79	78	73	72	0	0	2003
79	78	77	74	0	0	2002
74	73	71	69	0	0	2001

Rio Rancho NM site (approx. 40 miles from park near Albuquerque NM)

---------- 1- hour averages ----------						# Exceedences
1st Max	2nd Max	3rd Max	4th Max	Actual	Est.	Year
91	88	87	86	0	0	2003
93	87	87	87	0	0	2002
79	79	78	78	0	0	2001

---------- 8- hour averages ----------				# Exceedences		
1st Max	2nd Max	3rd Max	4th Max	Actual	Est.	Year
79	77	76	76	0	0	2003
82	81	76	76	0	0	2002
71	70	69	67	0	0	2001

Although criteria pollutants have not been measured, the NPS has conducted ambient monitoring for the purposes of tracking long- term visibility conditions since 1988 at the Monument. A summary of the results (Figure 3.4) shows the 20% worst visibility days in the area of Bandelier on average during calendar year 2002. Figure 3.5 shows the average visibility extinction for Bandelier from 1989- 2002.

Figure 3.4 The Average 20% Worst Visibility Days Near Bandelier During Calendar Year 2002. Smaller numbers represent better visibility. Source: VIEWS website for the Western Regional Air Partnership.

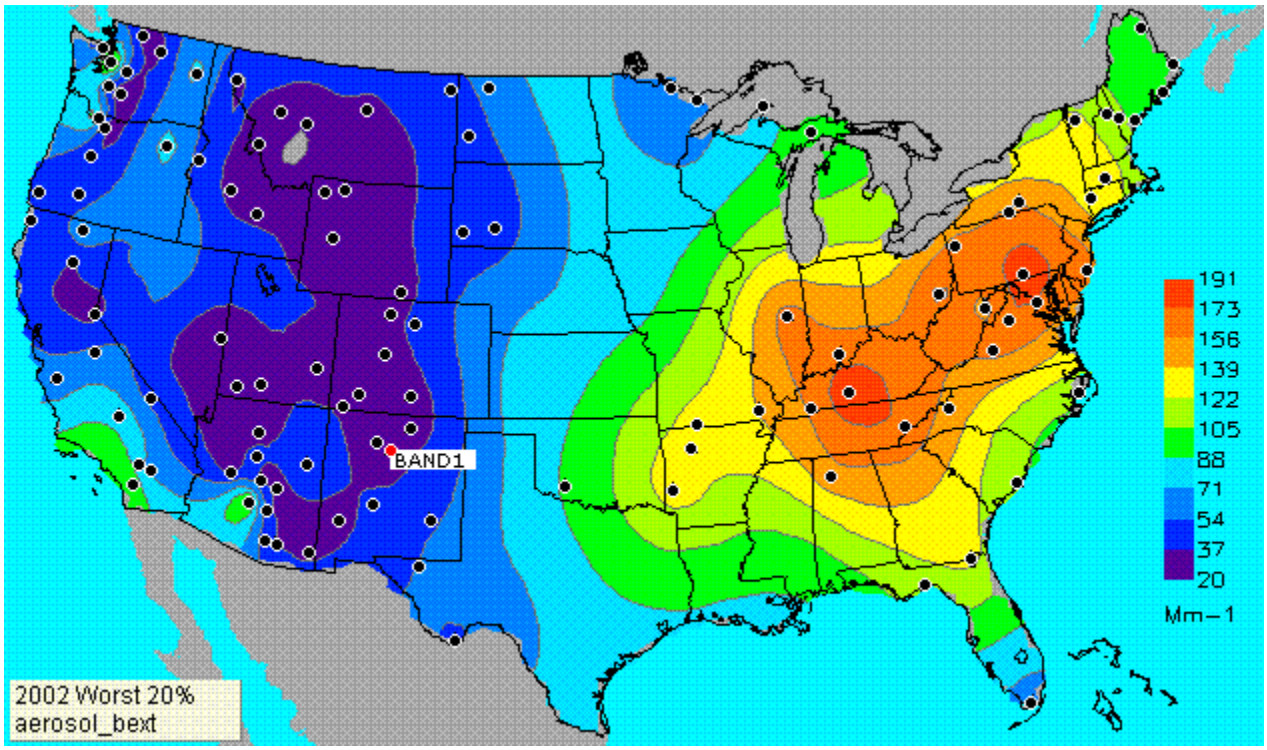
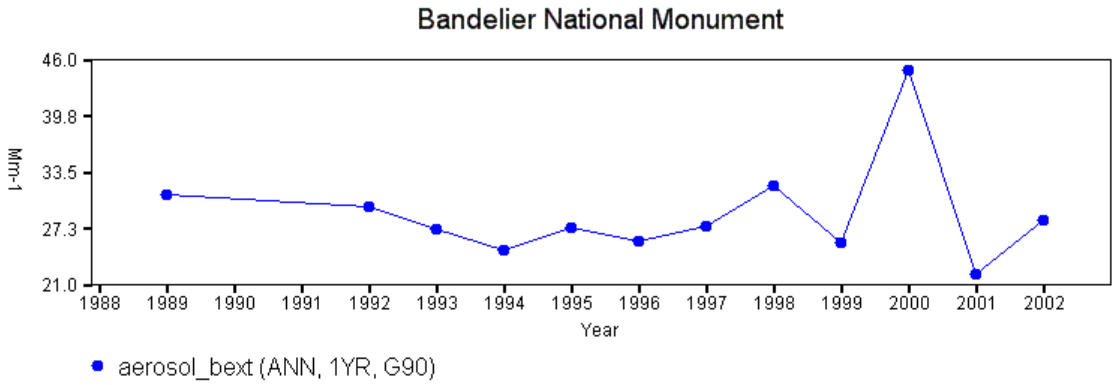


Figure 3.5. Average visibility extinction for Bandelier from 1989 to 2002. Source: VIEWS website for the Western Regional Air Partnership.



Emissions estimates in tons per year (tpy) for the area surrounding Bandelier are displayed in Table 3.11 and are comprised of annual totals for Sandoval, Santa Fe, and Rio Arriba counties. These data are derived from the EPA's National Emission Inventory for 1999 (the most current data available), and are for nitrogen oxides, sulfur dioxide, and PM- 2.5. All three pollutants can contribute to visibility impairment. NOx and SO2 can react in the atmosphere with other gases and form solid sulfate and nitrate, while PM- 2.5 is directly emitted fine particles. Table 3.11 shows that most nitrogen oxides and sulfur dioxide come from area or mobile sources, like dust and fire. The majority of PM- 2.5 emissions are found to be from area sources as well.

Table 3.11 Emissions totals for Sandoval, Santa Fe, and Rio Arriba Counties.

Pollutant	Point/ Industrial Sources (tpy)	Area/Mobile Sources (tpy)	Total Emissions (tpy)
NOx	**3,438**	**15,787**	**19,225**
SO2	**12**	**1,089**	**1,101**
PM- 2.5	**127**	**23,010**	**23,137**

Prevention of Significant Deterioration

Bandelier National Monument area is designated Class I under the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act. This legislation allows only limited increases (i.e., allowable increments) over baseline concentrations of pollution for sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM). The PSD permitting program is administered by the New Mexico Environment Department, and applies to defined categories of new or modified sources of air pollution with emissions that exceed a certain threshold and thus must acquire an air quality permit. No current determination of the status of PSD increments in the Monument is available.

Bandelier's air quality is protected in Class I areas through specific visibility protection regulations. These regulations pertain to pollution from large industrial sources and what is known as regional haze, which is caused by, as the name implies, a number of different sources over a large area rather than a single identifiable point source. In addition, the State of New Mexico has recently developed a plan that deals with smoke management and defines what is required of prescribed burns in order to comply with air quality regulations (Title 20, Chapter 2, Part 65 of the New Mexico Administrative Code (NMAC)). For instance, appropriate burning conditions must be defined for small burns; a registration, recordkeeping, and reporting system must be in place; and monitoring and public notice are required when burns occur near communities. For larger burns, self education on the program is required; alternatives to burning like mechanical treatment are to be considered; emission reduction techniques such as burning under certain moisture conditions are required; monitoring is necessary; registration, notification, and reporting for all burns are required; and recordkeeping is necessary. In addition, there are registration, notification, and monitoring requirements associated with WFURB.

CULTURAL ENVIRONMENT

Bandelier National Monument represents a Southwestern cultural heritage that spans from circa 10,000 B.C. to the present. Bandelier was created to protect its diverse array of cultural resources, which are located throughout all areas of the Monument. This section details the existing conditions for the archeological, cultural, historical, and ethnographic resources in the Monument.

ARCHEOLOGICAL RESOURCES

Archeological sites are spatially finite areas containing physical remains of past human activity, and they are important for the information they can provide regarding prehistoric and historic lifeways. They are also important to people as a tangible link to the past.

A large proportion of the sites in Bandelier relate to the Ancestral Pueblo occupation of the area dating from approximately A.D. 1175 to A.D. 1550, but sites pertaining to earlier and later periods are present as well. The prehistoric sites in the Monument consist of a range of archeological materials including flaked and ground stone tools, waste from tool manufacture, broken pottery, food processing features, fire hearths, structural remains, and rock art. Structural remains include 1- 2 room masonry structures, masonry pueblos containing 6 to 400 rooms, mixed masonry and adobe pueblos containing up to 40 rooms, cavate structures, and cavate pueblos. To date, 2,805 archeological sites have been recorded. Most sites with structural remains are located on mesa tops, canyon bottoms, and talus slopes up to 7,800 feet in elevation. Cavates and associated masonry structures are located at cliff bases and on talus slopes. Ceramic and lithic artifact

scatters occur throughout the Monument, including the high elevation areas where lithic scatters and quarries are common.

Historic archeological sites, distinct from historical resources discussed below, provide important information not available in written records, such as cultural patterns typically omitted from historical literature (related to gender and ethnic groups), early building construction techniques, lifestyles of early settlers, trade and procurement of goods and materials, and interactions with native peoples. Archeological sites pertaining to the historic period (post 1600) consist of wooden corrals, historic metal and glass artifact dumps, remains of log structures, water diversion structures, aspen dendroglyphs, historic telephone lines, abandoned trails, and abandoned roads. The locations of these sites are well documented. The Tsankawi Unit contains the remains of an adobe and masonry building that once housed an early 20th century learning center for pueblo women to improve their ceramic arts.

Approximately 68% of the Monument has been surveyed for archeological sites, with roughly 5% remaining to be surveyed between 2005 and 2009. Over 27% of the Monument can not be surveyed due to steep slopes (> 30 degrees).

ETHNOGRAPHIC RESOURCES

The NPS defines ethnographic resources as any "site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS, 2001a). Many Native American pueblos and tribes continue their traditional cultural association with National Park Service lands and resources. Of the 19 federally recognized Pueblo Indian groups in New Mexico, six pueblos have the closest cultural affiliation with Bandelier—the Pueblos of Santa Clara, Santo Domingo, San Ildefonso, San Felipe, Cochiti and Zuni.

A Memorandum of Understanding (MOU) regarding consultation between Bandelier and the six pueblos is currently in place. This MOU requires Bandelier to regularly and actively consult with these pueblos regarding fire planning, management, and operational decisions that affect subsistence activities, sacred materials or places, or other ethnographic resources with which they are historically associated. A Consultation Committee has been established consisting of tribal representatives from the six pueblos and serves to maintain an effective means of communication and consultation between Bandelier and Pueblo Indian communities that are traditionally associated with Bandelier National Monument.

Bandelier currently consults with the Consultation Committee regarding annual fire programs and in emergency wildland fire situations and/or general park management issues. In general, the Consultation Committee has expressed concerns about landscape changes caused by fire exclusion, the abundance and vigor of traditionally used plants (many of which were managed by fire), habitat for wildlife (which was historically maintained by periodic fire), and protection of archeological sites and features.

Consultation with affiliated Pueblos on the FMP was initiated November 5th, 2003. To date, consultation efforts have included mailing scoping brochures that seek input on planning efforts to all 19 pueblos; participation in regular tribal consultation meetings; and conducting meetings with individual pueblos to address any specific concerns related to the proposed Fire Management Plan. Focused, detailed consultation with the pueblos is currently on- going.

CULTURAL LANDSCAPE RESOURCES

A cultural landscape is a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. Shaped through time by historical land use and management practices, as well as politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past, a visual chronicle of its history. The NPS defines and actively manages four types of cultural landscapes: designed landscapes, vernacular landscapes, historic sites, and ethnographic landscapes (Birnbaum, 1994).

Bandelier protects two types of cultural landscapes, an ethnographic landscape at Tsankawi and a designed landscape that includes the Bandelier National Monument Civilian Conservation Corps (CCC) Historic District, which is described below under "Historical Resources."

The detached Tsankawi Unit of the Monument, identified as an ethnographic cultural landscape, is composed of Tsankawi pueblo, an ancestral pueblo village with the remains of fields, smaller pueblos, field houses, cavate structures, and other cultural features such as footpaths that crisscross the land and link the pueblo with other pueblos in neighboring canyons. The views from the mesa are integral to the landscape, with 360-degree views of the Sangre de Cristo and Jemez mountain ranges, the Rio Grande Valley, and isolated and culturally important features like other Ancestral Pueblo villages. Essentially, the entire Tewa World (Ortiz, 1969) is visible. A level II cultural landscape inventory (CLI) of the Tsankawi Unit was completed in 1999 (NPS, 2004a).

The Bandelier National Monument CCC Historic District (more fully described under Historic Properties) is a designed cultural landscape that is part of the larger Frijoles Canyon Cultural Landscape. The Frijoles Canyon Cultural Landscape includes the canyon itself with its narrow, steep sides; its perennial stream, and its historic and prehistoric structures. The canyon has been home to Ancestral Pueblo peoples, a grazing and farming area for Hispanic and Pueblo peoples, a guest lodge, housing for Manhattan Project scientists, and a destination for tourists (NPS, 2002). A level II CLI was completed in 2000 for the Frijoles Canyon Cultural Landscape (NPS, 2004b).

HISTORIC RESOURCES

Historical resources are historic properties that retain some aspect of their original function. Examples at Bandelier include historic buildings originally used as guest rooms now converted into NPS office space, or historic drainage gutters that still retain their original function.

The primary historic resource in the Monument is the Bandelier National Monument CCC Historic District, which is listed as a National Historic Landmark. The district contains 31 buildings of pueblo revival design executed with a solid architectural unity that mimics a small New Mexican village. Also included are the entrance road and associated drainage gutters, and other minor stone structures (Harrison, 1988). In addition to the stone buildings, which are used for visitor facilities, residences, offices, the fire tower, and the entrance station, the CCC enrollees also made hand- carved wooden furniture and pierced- tin light fixtures to furnish the buildings. The district is an excellent example of NPS architecture, or "parkitecture," that developed in the 1920s and 1930s. The district is also the largest collection of CCC- built structures not altered by the addition of new structures within the district.

SOCIAL ENVIRONMENT

This section details the existing conditions for Public Health and Safety and Visitor Use and Experience.

PUBLIC HEALTH AND SAFETY

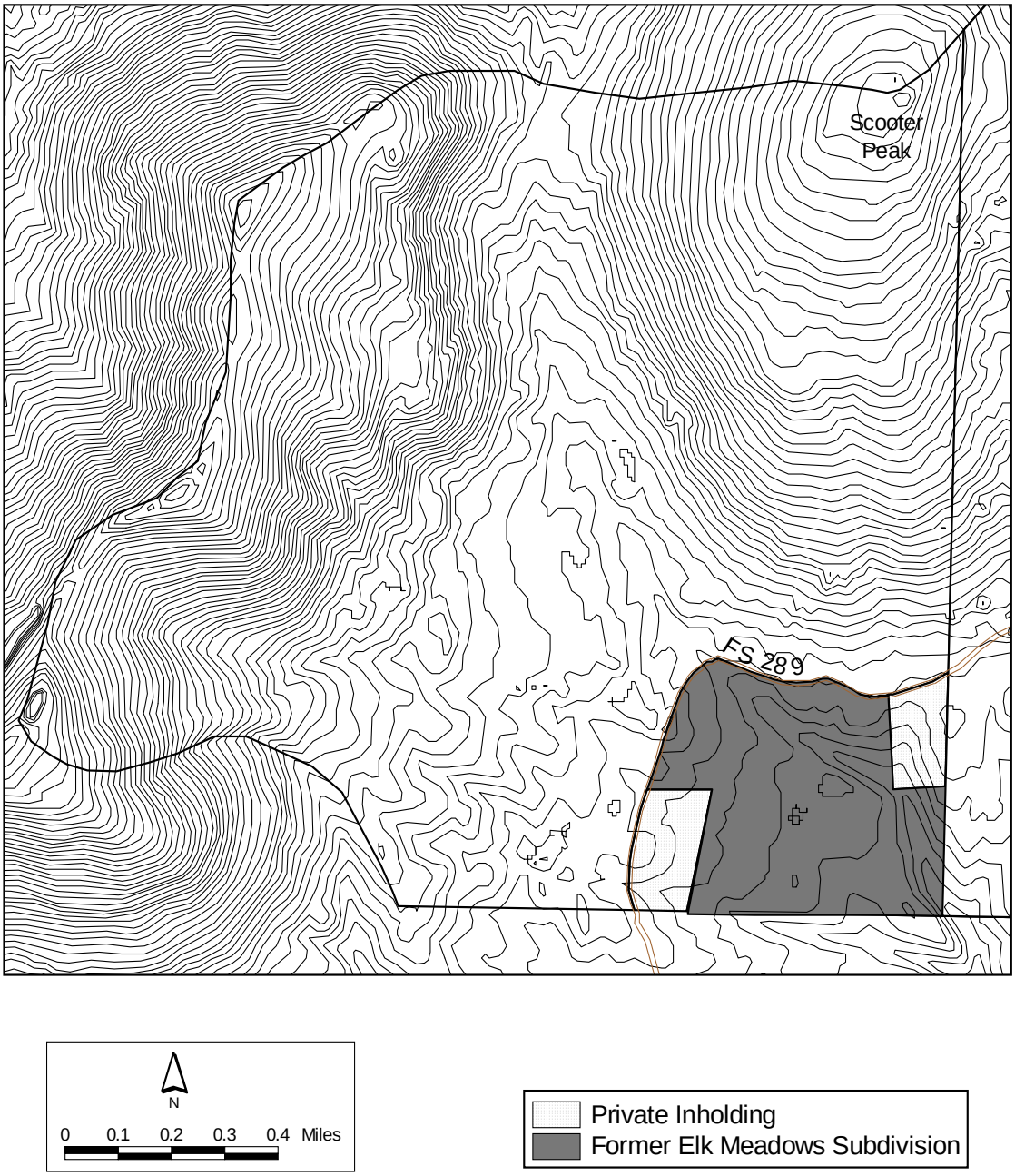
The health and safety of Monument visitors, Monument staff, and fire personnel are the highest priority to the NPS. Wildland fires and other fire management activities can present risks to both the public and Monument employees.

Two private inholdings exist within Bandelier in the Elk Meadows Area (Figure 3.6). Other lands that border the Monument boundary include those administered by the U.S. Forest Service (USFS), the State of New Mexico, Valles Caldera National Preserve, San Ildefonso Pueblo, and the Los Alamos National Laboratory. The town of Los Alamos, population 18,000, is located approximately 10 miles from the entrance of Bandelier and less than 5 miles from the nearest Monument boundary. The community of White Rock, population 7,000, lies approximately 8 miles southeast of Bandelier.

Bandelier staff levels vary seasonally; approximately 50 employees and volunteers live in onsite employee housing during the summer, and 25 during the winter. Visitors to the Monument now average about 300,000 annually, with peak visitation in June, July, and August.

All employees and visitors are at risk from wildland fire in the Monument, and firefighters and fire staff face direct risks. Health and safety risks peak in the pre-monsoon months (late spring and early summer), when fire danger is generally higher. Impacts are immediate when there is a fire and threats persist through high fire danger seasons. Both Bandelier and the USFS distribute health and safety information to visitors. Bandelier personnel are responsible for assisting and directing visitors appropriately when wildland fire threats become severe. This could include closing part or all of the Monument or evacuating nearby residential communities. For additional information on public and firefighter safety see "Chapter 2: Features Common to All Alternatives: Public and Firefighter Safety."

Figure 3.6 Private Inholdlngs and Former Elk Meadows Subdivision in Bandelier National Monument



9/27/04 K.Beeley, Bandelier National Monument

VISITOR USE AND EXPERIENCE

Visitation

Bandelier National Monument is one of the larger, more visited NPS units in New Mexico. It is located approximately 50 miles northwest of Santa Fe, west and south of New Mexico Route 4. Bandelier is open year round, with shorter visitation hours in the winter months. Visitation reports for the past 20 years show that the number of visitors generally increased from 1981 to the mid 1990s, with visitation peaking at over 400,000 in 1994. In the late 1990s, visitation decreased, and the latest figures show visitation leveling out at near 300,000 visitors annually.

According to the 1995 Visitor Survey Report, Bandelier receives 50% of its visitors during the summer months of June, July, and August. Peak visitation occurs in July for most years. Table 3.12 shows the monthly visitation for 2003. Weekend use normally exceeds weekday use; the average stay is approximately 2- 3 hours; and most visitors are day- trippers from Santa Fe.

Table 3.12 Monthly Visitation Report for 2003, Bandelier National Monument

Month	Year	Visits
January	2003	10,656
February	2003	10,043
March	2003	20,939
April	2003	25,825
May	2003	35,748
June	2003	35,516
July	2003	35,868
August	2003	34,110
September	2003	26,216
October	2003	28,149
November	2003	12,196
December	2003	9,772
Total		287,935

Visitor Use Areas and Services

The NPS holdings that comprise Bandelier exist in two noncontiguous parcels: (1) the main unit that includes Frijoles Canyon, where the cliff dwellings and visitor center are located; and (2) the Tsankawi unit, where more limited visitor use occurs. As stated above, the Monument shares borders with the Department of Energy (Los Alamos National Laboratory), the Santa Fe National Forest, the Valles Caldera National Preserve, the State of New Mexico, and San Ildefonso Pueblo. Visitor use of the Monument is influenced by the availability of services and facilities on lands near the Monument. For example, the broadscale availability of camping areas on the Santa Fe National Forest reduces visitor use of Bandelier's lower elevation front country campground. The lack of many group camping facilities in the Jemez Mountains results in the concentrated use of Bandelier's frontcountry group campground (Ponderosa Campground).

The following list provides detailed descriptions of Bandelier's visitor use areas and services offered:

Frijoles Canyon (Cliff Dwellings and Trail/Visitor Center)
This is the primary visitor use area, providing the main interpretive activities offered at the Monument. The cliff dwellings, or cavate structures, and ancestral pueblo villages are located immediately behind the visitor center. Over 98% of Monument visitors walk on the 1 mile Main Loop Trail through Tyuonyi pueblo and the surrounding cavates. Many continue an additional mile to Alcove House.

Visitor Center
The Visitor Center, located in the heart of Frijoles Canyon, is the primary entry and exit point for all Monument visitors. Visitors can obtain information about the primary features of the Monument, scheduled activities, and the local area. A small museum houses cultural history exhibits, and an audio- video program and bookstore are available.

Campgrounds
Two frontcountry campgrounds, Juniper and Ponderosa, are located in the Monument. Juniper Campground contains 94 individual sites. Ponderosa Campground contains two group sites that can accommodate up to 50 people each. Both are developed campsites with picnic tables, grills, running water, and toilets. Camping fees are charged for both areas.

Trails
Bandelier contains more than 23,000 acres of designated wilderness with more than 70 miles of hiking trails. Thirty- nine miles are part of the National Trails System. The terrain can be challenging and the scenery spectacular. Elevations range from 5,000 to 10,000 feet. Lush, narrow canyons alternate with sweeping mesa- top vistas. Free permits for overnight camping are issued at the visitor center. Three trailheads provide access for stock users to many miles of backcountry trails.

Tsankawi Unit
The Tsankawi Unit is located in a separate parcel near the town of White Rock approximately 15 miles northeast of the Monument headquarters. The unit contains Tsankawi Pueblo, an ancestral village of San Ildefonso Pueblo, and 148 other archeological sites including small pueblos, field houses, artifact scatters and petroglyph panels. It is primarily visited by local area residents.

SPECIAL DESIGNATIONS

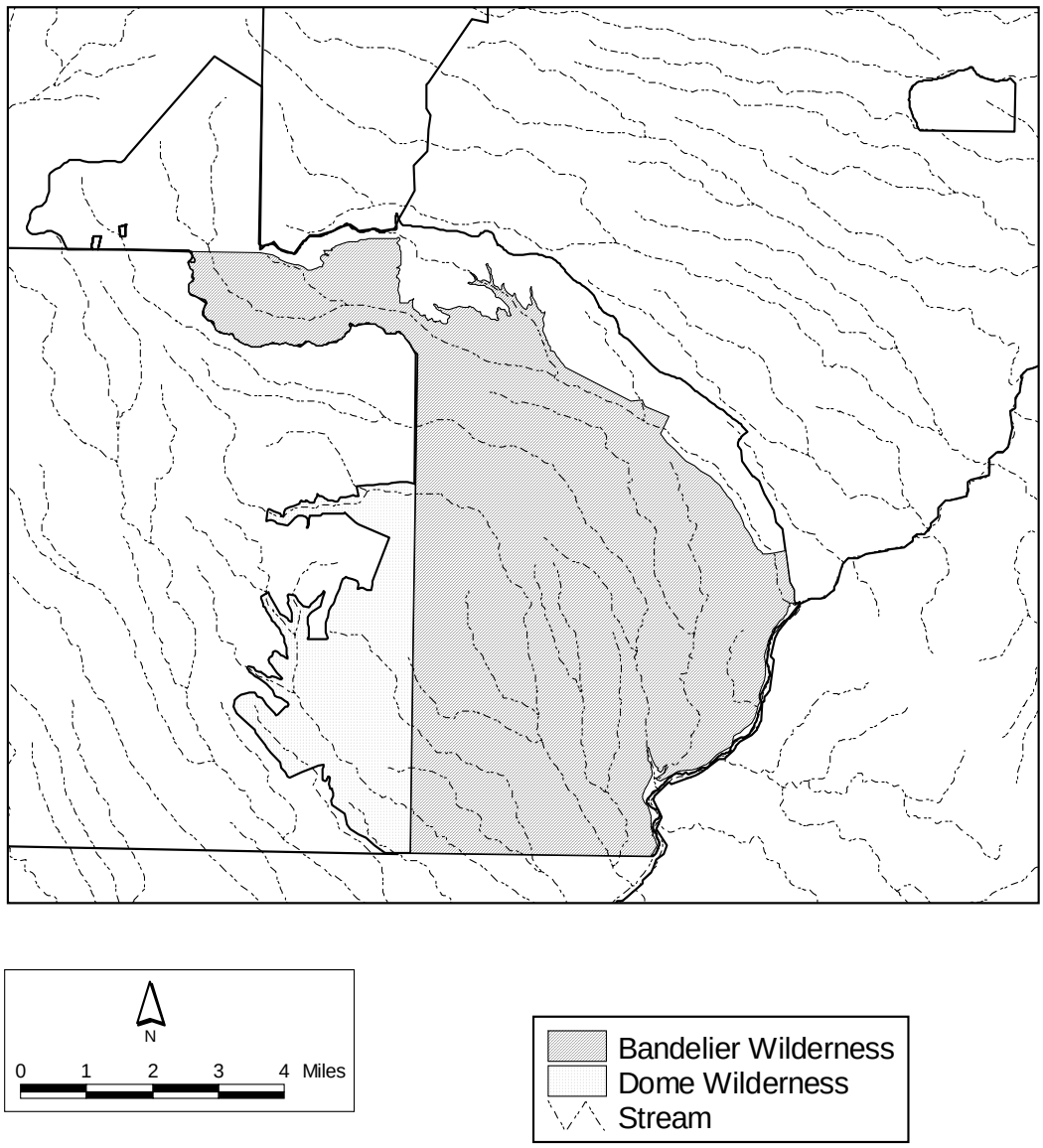
This section details the existing conditions for Bandelier's wilderness.

WILDERNESS

Bandelier has 23,267 acres of designated wilderness (Figure 2.7), covering nearly 70% of the Monument. Bandelier's wilderness was created by Congressional approval and signed into law by President Ford in 1976. Bandelier's wilderness contains all vegetation communities present in the Monument, although the majority of it is composed of lower elevation pinyon- juniper woodlands. The north- western portion contains a mosaic of grasslands, ponderosa pine forests, and small patches of mixed conifer communities.

Bandelier's wilderness borders the USFS Dome Wilderness area (Figure 3.7). Recreational uses in Bandelier's wilderness include backpacking, hiking, horse packing, and back country camping. Some of the areas proposed for treatment in the FMP are located in Bandelier's wilderness.

Figure 3.7 Bandelier's Wilderness and the USFS Dome Wilderness Area



9/27/04 K.Beeley, Bandelier National Monument

Chapter 4
ENVIRONMENTAL CONSEQUENCES

IMPACT ASSESSMENT METHODOLOGY

This chapter describes the environmental consequences, or potential impacts, on the biological, physical, cultural, and social environment at Bandelier National Monument from implementation of the three alternatives considered in this EA. The impact topics discussed are the same as those described in Chapter 3, Affected Environment.

General Methodology

The impact of implementing each alternative is evaluated for each impact topic. Impacts are described in terms of the type of impact, the duration of impact, and intensity of impact:

The ***type*** of impact describes a relative measure of beneficial or adverse effects on biological or physical systems, cultural resources, or the social environment. For example, adverse impacts on ecosystems might be those that would degrade the size, integrity, or connectivity of a specific habitat. Conversely, beneficial impacts might enhance ecosystem processes or increase native species richness.

The ***duration*** of the effect of an impact (short- term or long- term) is important to consider, especially because some impacts could have short- term adverse effects while having long- term beneficial impacts (and vice- versa). Effects from fire management activities described in this document are likely to occur within nested long- and short- term time scales. For example, after a fire some burned areas are likely to show signs of restoration within one or two growing seasons, while, on a landscape scale, the benefits of restoring fire may take years.

Measures of ***intensity*** consider whether an impact would be negligible, minor, moderate, major, or in some cases irreversible. These designations are used to describe both beneficial and adverse impacts.

Impacts may also be described as direct or indirect. Direct impacts are caused by an action and occur at the same time and place as the action. Indirect impacts are caused by an action and occur later in time or farther removed from the area, but are reasonably foreseeable.

Cumulative Impacts Analysis

The Council on Environmental Quality (CEQ) regulations require an assessment of cumulative impacts when implementing NEPA. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In this analysis, Cumulative impacts were determined by combining the effects of each alternative with other past, present, and reasonably foreseeable future actions.

Impairment Analysis

This document also evaluates whether resources might suffer impairment. Impairment may result from proposed alternatives. According to NPS policy, "An impact would be more likely to constitute an impairment to the extent that it affects a resource or a value whose conservation is: a) Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; b) Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or c) Identified as a goal in the park's general management plan or other relevant National Park Service planning documents." (National Park Service Management Policies, Part 1.4.5, 2001). Impairment is discussed in the conclusion section for each alternative under the appropriate impact topic.

BIOLOGICAL ENVIRONMENT

VEGETATION

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The information provided below was obtained through discussion with local fire management personnel and ecologists with professional knowledge of vegetation and its response to fire, unpublished reports, research and monitoring data, and existing scientific literature. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions.

Type of Impact

Adverse: The system moves away from the desired future conditions (as described in Chapter 2: The Alternatives) and natural range of variability for the vegetation structure, composition, and fuels.

Beneficial: The system moves within or toward the desired future conditions (as described in Chapter 2: The Alternatives) and natural range of variability for the vegetation structure, composition, and fuels.

Duration of Impact

Short- term: Beneficial or adverse impacts occur within 20 years.

Long- term: If adverse impact, it will take longer than 20 years for the system to move toward or be maintained within the DFC's. If beneficial impact, the system will continue moving toward or be maintained within the DFC's after 20 years.

Irreversible: It is predicted that the system will not move toward or be maintained within the DFC's.

Intensity of Impact

Negligible: Imperceptible or undetectable effects on the vegetation structure, composition, and fuels.

Minor: Slightly perceptible effects on the vegetation structure, composition, and fuels could occur, but would be short- term and on a small scale. Mitigation measures to offset adverse effects may be required and would likely be effective.

Moderate: Apparent changes in vegetation community structure, composition, and fuels could occur on a scale that represent a change in the role of fire, ecological function, vegetation type, or fire regime. Mitigations to offset adverse effects would likely be effective.

Major: Substantial changes in vegetation community structure, composition, and fuels could occur that represent a change in the role of fire, ecological function, vegetation type, or fire regime on a landscape scale. Mitigations to offset adverse effects would likely be extensive and the effectiveness would be unknown.

The following vegetation communities are included in the analysis: (see Chapter 3: Affected Environment for a detailed description of each vegetation community. Also see Chapter 2: The Alternatives for a detailed description of desired future conditions for each vegetation community).

1. **Pinyon- juniper savannas and woodlands and juniper- shrub grasslands:** These two communities are analyzed together because they would have similar responses to fire management actions and activities. Juniper- shrub grasslands are characterized by the presence of a one- seed juniper overstory with an understory of various shrubs, grasses and forbs. Pinyon- juniper savannas and woodlands are characterized by overstory dominance of Colorado pinyon pine and/ or one- seed juniper.

2. **Ponderosa pine savannas and forests:** Dominated by a mature ponderosa pine overstory with a variety of grass- forb, shrub, and tree understories depending on elevation and aspect as well as recent fire history.

3. **Mixed conifer forests:** Mixed conifer forests are characterized by a mixed overstory of mostly coniferous species (i.e. dominated by Engelman spruce and Douglas fir with subdominants being ponderosa pine, white fir, aspen, and limber pine).

4. **Aspen groves:** These communities are dominated by an overstory of aspen with an understory of grasses and forbs.

5. **Montane grasslands, wet meadows, and other grassland types:** Montane grasslands are grass and forb dominated openings within mixed conifer or aspen forests on southerly exposures of upper mountain slopes. Wet meadow areas are similarly situated grassy openings within mixed conifer forests, but located at the low gradient base of mountain slopes where snow runoff accumulates in late spring. Other montane grasslands include those grassy areas of more recent origin which may exist as a result of recent crown fire.

6. **Canyon riparian:**
   This complex is a narrow riparian zone which includes dominant overstory elements from vegetation types immediately upslope and those additional floristic elements requiring enhanced moisture regimes. Reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa, or mixed conifer) when considering fire regimes and fire behavior fuel models.

Note: The canyon slope complex was not analyzed independently because it closely resembles the vegetation community on adjacent mesas and mountain slopes, but with some additional floristic elements favoring steep, rocky or extreme north/south exposures. Reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa pine, and mixed coniferous) when considering impacts on this vegetation community.

Impact Analysis Common to All Alternatives and All Vegetation Communities:

Prescribed Fire and WFURB

Many factors, including a high concentration of lightning strikes, climatic conditions, and topography, make fire one of the dominant natural disturbance processes at Bandelier (see Appendix C for a detailed description of fire history in Bandelier and the Jemez Mountains). Consequently, most of the vegetation communities that have persisted through time are either fire-dependent or enhanced by fire. Because Bandelier's native plant communities are adapted to the effects of periodic surface fires, prescribed fire and WFURB generally produce beneficial impacts on these communities. Immediately following fire, there is an increased availability of resources for plants, such as space, light, water, and nutrients. Space is created when fire kills individual plants, providing the opportunity for other plants to colonize the area. Light penetration is increased when fire kills individual trees or burns portions of trees and opens the canopy. Increased water availability is a result of a reduction in transpiring leaf surface areas (Bond and Wilgen, 1996). Fire initiates nutrient cycling processes by converting nutrients, normally bound in organic matter, to a form that is available to plants. Fire can also benefit plants by temporarily reducing seed predators. Phenomena such as fire stimulated flowering, seed release, and germination occur in many species that have evolved with fire (Bond and Wilgen, 1996).

Fire has beneficial affects on the survival and reproduction of many plant life forms, as well as communities. For example, grasses and forbs generally respond to fire by either resprouting or establishing new seedlings. Woody plants that can resprout tend to thrive after fire. Communities, such as southwestern ponderosa pine forests, benefit through a reduction in stem density, a temporary reduction of understory shrubs (releasing nutrients for the pine), and a reduction of surface and ladder fuels (protecting ponderosa pine from more severe fires).

Below is a more detailed description of how prescribed fire and WFURB would affect each vegetation community:

Pinyon- juniper savannas and woodlands and juniper- shrub grasslands: The juniper shrub grasslands incorporate former shrub and grassland communities recently invaded (downslope) by juniper. The pinyon and juniper savannas and woodlands have expanded their ranges (upslope) into the ponderosa pine understory. Density of trees has increased dramatically throughout both of these vegetation communities. The understory is generally sparse with patches of exposed soil, causing increased erosion. These changes are thought to be a result of historic grazing and loss of fire regime since 1880. Major restoration efforts would be required on most pinyon- juniper woodland savannas and woodlands before sufficient surface fuels were available to carry a fire. Until additional restoration activities are complete, fire suppression would be the only fire management activity in this vegetation community. Therefore, there would be no impacts from prescribed fire and WFURB.

Ponderosa pine savannas and forests and mixed conifer forests: Fire suppression and overgrazing in Bandelier's ponderosa pine forests have resulted in increasing stand densities of ponderosa as well as recruitment of pinyon- juniper (upslope) and mixed conifer (downslope). The absence of fire from mixed conifer forests has resulted in increased densities of shade tolerant trees (white fir) in the understory and extreme fuel loadings. Both vegetation communities would benefit from fire through a reduction in stem density, a temporary reduction of understory shrubs (releasing nutrients), an increase in native perennial herbaceous vegetation, increased species

diversity, and a reduction of surface and ladder fuels (protecting the forests from more severe fires). There would also be short- term adverse impacts to vegetation in these communities, such as direct mortality, but the long- term result would be the creation of vegetative mosaic patterns that more closely resemble forest structure, composition, and fuel levels before fire suppression and overgrazing occurred. With repeated prescribed fires and WFURB over the long- term, the forests would become more resistant and resilient to fire as they were historically.

Aspen: Aspen is considered a potentially long- lived, but fire dependent seral stage which colonizes 'holes' created in mixed coniferous forests created by fire. Interference with natural fire cycles threatens the existence of aspen because aspen clones will yield dominance to mixed conifer establishment in the absence of periodic fire. Aspen responds vigorously after moderate intensity fires that remove part of the litter and duff, kill a portion of the tree canopy, and increase soil temperatures to between 60 - 95 °F. These conditions are the most effective in stimulating suckering in aspen (Wright and Bailey, 1982). Therefore, impacts to aspen from prescribed fire and WFURB would be adverse, short- term, and minor as well as beneficial, long- term, and moderate.

The following mitigation measures have been developed to address the potential synergistic effects of fire and ungulate browsing:

- Fire and resource personnel will conduct monitoring and research of aspen and deciduous shrub species response to fire.
- Fire and resource personnel will implement mitigation measures prior to prescribed burning if deemed necessary by research and monitoring results. Examples of mitigation measures may include but are not limited to: 1) evaluate burning activities in selected aspen groves based on information gathered from research and monitoring, and 2) create or install exclosures to protect or study response of deciduous species.

Montane grasslands, wet meadows, and other grassland types: Fire, in combination with other factors such as climate and topography, plays a major role in the maintenance of grasslands (Wright and Bailey, 1982). All of the montane grasslands in Bandelier are interspersed with or bounded by stands of mixed conifer and aspen and can be considered a fire dependent seral stage since they will yield to mixed conifer establishment in the absence of fire. Prescribed fire and WFURB would produce the beneficial impact of slowing this woody plant encroachment on grasslands and meadows, as well as initiating nutrient cycling processes. Overall, impacts would be beneficial, long- term, and moderate as well as adverse, short- term, and minor.

Canyon riparian:
This narrow riparian zone includes dominant overstory elements from vegetation types immediately upslope and those additional floristic elements requiring enhanced moisture regimes. Reference should be made to the dominant overstory vegetation (i.e. pinyon- juniper, ponderosa, or mixed conifer) when considering impacts of fire management actions and activities. This is a fairly intact community and fire regimes are comparable to the adjacent vegetation communities. Therefore, impacts of prescribed fire and WFURB would be the same as under pinyon- juniper savannas and woodlands, juniper- shrub grasslands, ponderosa pine savannas and forests, and mixed conifer forests: adverse, short- term, and minor to moderate as well as beneficial, long- term, and minor to moderate.

Fire Suppression
Fire suppression activities could include the construction of helispots, spike camps, and hand line, hand thinning, snagging, mop up, and dropping water and fire retardant (see Glossary for definitions). The effects of these activities would be expected to be the same for all vegetation communities.

Helispots, spike camps, hand line, and mop up would disturb surface vegetation and soils, potentially opening micro- sites for invasion by non- native species. Snagging and hand thinning could also disturb surface vegetation and soils and the piling of vegetation could lead to unnaturally high concentrations of fuels. Vegetation can be physically damaged from the impact of dropping water or fire retardant, but the area of impact tends to be small and the effects would be relatively local. Most fire retardant contains fertilizer- type compounds, including ammonia, nitrogen, and phosphorous, that can affect vegetation. However, the chemical components of retardant remain only until they are removed by rain or erosion (USDA, 1998) and there have been no toxicological studies published that show substantial effects of fire retardant chemicals on vegetation (Hamilton, 1998).

The effects of the above fire suppression activities would generally be local and would not have substantial effects on vegetation or have landscape- scale implications. Therefore, impacts would be adverse, short- term, and minor to moderate. The following set of mitigations would be implemented under all alternatives to reduce soil erosion that could affect vegetation (i.e. through direct mortality, prohibiting the establishment of seeds) (see Chapter 2: Mitigations Common to All Alternatives for a detailed description of each mitigation):

- Mulching
- Aerial or hand seeding with native plants
- Contour felling and bucking of small trees or using straw wattles
- Slashing by felling, lopping, limbing, and scattering of trees
- Sand/soil bags and trenching
- Rock and log grade stabilizers
- Check dams constructed with rock, fence, logs, straw bales, or straw wattles
- Raking of soil

In addition, fire retardant would only be used for initial attack on a fire. Beyond initial attack, it will require approval from the Superintendent. Firefighters would also refer to the Minimum Impact Suppression Tactics guide (see Appendix D).

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

Prescribed Fire, WFURB, and fire suppression
Overall, impacts to vegetation communities would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. See "Impact Analysis Common to All

Alternatives and All Vegetation Communities" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile Burning
Piles of live and dead fuels would generally burn much hotter than broadcast prescribed fire and WFURB. They would create patches of moderately to severely burned soils where physical, chemical, and biological characteristics would be expected to change. The soil in these areas may also become hydrophobic. However, because these patches would be relatively small and pile burning under Alternative 1 would be used only moderately, the biological function of soil in the patches would quickly return. There would also be impacts to vegetation from dragging materials to each pile. These impacts would be short- term and localized. Overall, the impacts to vegetation communities from pile burning would be adverse, short- term, and negligible to minor. To ensure that impacts from pile burning would be minimized, piles would be kept small (the size of a small car). The small size would minimize the extent of vegetation and soil damage and also allow for the recolonization of sterilized patches by mycorrhizal fungi and other soil organisms. This would facilitate nutrient cycling processes and help plants to re- establish.

Thinning Activities
Pinyon- juniper savannas and woodlands and juniper- shrub grasslands: As mentioned above under "Impact Analysis Common to All Alternatives and All Vegetation Communities," fire suppression would be the only fire management activity in this vegetation community. Therefore, there would be no impacts from manual and mechanical thinning projects.

Ponderosa pine savannas and forests and mixed conifer forests:
Thinning with hand tools or chain saws could result in soil compaction and vegetation trampling on a localized scale. However, thinning also produces beneficial impacts, such as reducing the density of understory trees and shrubs (reducing ladder fuels) and increasing light penetration to the forest floor. Under Alternative 1, thinning with hand tools and chain saws in ponderosa pine and mixed conifer forests would occur most aggressively in the WUI, producing minor to moderate localized impacts. These activities would also occur in non- WUI, non- wilderness, but in a less aggressive manner. Impacts would be minor. In wilderness areas, thinning with hand tools would be allowed if it did not negatively affect wilderness character or values. Thinning with chainsaws would not be allowed in wilderness, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions, it is unlikely that thinning with chain saws would have impacts on these vegetation communities in wilderness areas. Overall, impacts on these vegetation communities from manual thinning activities would be adverse, short- term, and range from minor to moderate, as well as beneficial, long- term, and negligible to minor.

Mechanical thinning under Alternative 1 includes all possible mechanical apparatus (such as chippers, loaders, etc.), although no dozers are allowed in the Monument. The following soil mitigations, which would benefit vegetation communities (i.e. by promoting a favorable soil environment for seed germination and establishment), would be implemented:

- Minimize the effects of soil compaction due to mechanical thinning activities by spreading slash on the ground.
- Conduct mechanical thinning activities during winter months when the soil is frozen.
- Rake appropriate areas after mechanical treatments.

The use of mechanical thinning equipment could result in soil compaction and vegetation trampling, which can increase erosion rates. However, removal of trees through mechanical thinning also produces beneficial impacts, such as reducing tree densities (reducing ladder fuels) and opening the forest canopy. An open forest canopy decreases the chance of continuous crown fire and increases light penetration, important for herbaceous plants, to the forest floor.

Under Alternative 1, mechanical thinning in ponderosa pine and mixed conifer forests would occur most aggressively in the WUI, producing minor to moderate localized impacts. These activities could also occur in non- WUI, non- wilderness, but in a less aggressive manner and without the use of dozers. Impacts would be minor. In wilderness areas, mechanical thinning would not be allowed, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions, it is unlikely that mechanical thinning would have impacts on these vegetation communities in wilderness areas. Overall, impacts on these vegetation communities from mechanical thinning would be adverse, short- term, and range from minor to moderate, as well as beneficial, long- term, and minor to moderate.

Aspen:

As mentioned above, thinning with hand tools or chain saws could result in soil compaction and vegetation trampling on a localized scale. However, moderate amounts of thinning in aspen can also produces beneficial impacts, such as reducing the density of trees, increasing light penetration to the forest floor, and stimulating suckering. Under Alternative 1, thinning with hand tools and chain saws in aspen would occur most aggressively in the WUI. However, because there is a relatively small amount of aspen in the WUI, the overall impact would be minor. Most of the Monument's aspen clones are in non- WUI, non- wilderness areas (in the Cerro Grande area), where manual thinning activities could also occur, but in a less aggressive manner than in the WUI. Impacts would also be minor. In wilderness areas, thinning with hand tools would be allowed if it did not negatively affect wilderness character or values. Thinning with chainsaws would not be allowed in wilderness, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions and the fact that there is a relatively small amount of aspen in wilderness, it is unlikely that thinning with chain saws would have impacts on aspen in wilderness areas. Overall, impacts on aspen from manual thinning activities would be adverse, short- term, and minor, as well as beneficial, long- term, and negligible to minor.

The use of mechanical thinning equipment could result in soil compaction and vegetation trampling, increasing erosion rates. However, mechanical thinning in aspen can produce beneficial impacts such as reducing ladder fuels, decreasing the chance of continuous crown fire, increasing light penetration to the forest floor, and stimulating suckering. Under Alternative 1, mechanical thinning in aspen would occur most aggressively in the WUI. However, because there is a relatively small amount of aspen in the WUI, the overall impact would be minor. Most of the Monument's aspen clones are in non- WUI, non- wilderness areas (in the Cerro Grande area), where the topography may limit the amount of mechanical thinning that could occur, but impacts could still be minor to moderate. In wilderness areas, mechanical thinning would not be allowed, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions and the fact that there is a relatively small amount of aspen in wilderness, it is unlikely that mechanical thinning would have impacts on aspen in wilderness areas. Overall, impacts on aspen from mechanical thinning would be adverse, short- term, and minor, as well as beneficial, long- term, and negligible to minor.

Montane grasslands, wet meadows, and other grassland types:
Manual thinning with hand tools and chain saws could both directly and indirectly affect grasslands and meadows. Direct impacts would be adverse and short- term and would consist of soil compaction and vegetation trampling in areas where grasslands and meadows are used to access forest areas. Indirect impacts would be beneficial and long- term and would result from the thinning of forests surrounding grasslands and meadows, thereby slowing tree and shrub invasions.

Under Alternative 1, thinning with hand tools and chain saws would occur most aggressively in the WUI. Because there is a relatively small amount of grasslands and meadows in the WUI, the overall impact would be minor. A large portion of the Monument's grasslands and meadows are in non-WUI, non- wilderness, where manual thinning activities could also occur, but in a less aggressive manner than in the WUI. Impacts would be minor. There is also a large portion of the Monument's grasslands and meadows in wilderness areas, where thinning with hand tools would be allowed if it did not negatively affect wilderness character or values. Thinning with chainsaws would not be allowed in wilderness, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions, it is unlikely that thinning with chain saws would have impacts on grasslands and meadows in wilderness areas. Overall, impacts on grasslands and meadows from manual thinning activities would be adverse, short- term, and minor, as well as beneficial, long- term, and minor.

The use of mechanical thinning equipment could result in soil compaction and vegetation trampling, increasing erosion rates. However, mechanical thinning can also help to perpetuate the existence of grasslands and meadows in the Monument by slowing woody plant encroachment. Under Alternative 1, mechanical thinning would occur most aggressively in the WUI. Because there is a relatively small amount of grasslands and meadows in the WUI, the overall impact would be minor. A large portion of the Monument's grasslands and meadows and all of the Monument's montane meadows are in non- WUI, non- wilderness, where mechanical thinning could also occur. Mitigations as listed above would be implemented and would likely be successful, no dozers are allowed in the Monument, and topography may limit access to vehicles and equipment in montane grassland areas, but there would still be potential for adverse, minor to moderate impacts due to soil compaction and vegetation trampling caused by equipment and vehicles that use grasslands and meadows to access forested areas during thinning operations. There is also a large portion of the Monument's grasslands and meadows in wilderness areas, where mechanical thinning would not be allowed, unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions, it is unlikely that mechanical thinning would have impacts on grasslands and meadows in wilderness areas. Overall, impacts on grasslands and meadows from mechanical thinning activities would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor.

Canyon riparian:
The canyon riparian community exists mainly in wilderness areas, where manual thinning with chain saws and mechanical thinning would not be allowed unless in suppression situations, using the Minimum Requirements Decision Guide (Carhart Center, 2002), and with approval from the Superintendent. Because of these restrictions and the fact that riparian areas are limited in access, it is unlikely that manual thinning with chain saws and mechanical thinning would have impacts on this vegetation community. However, manual thinning with hand tools would be allowed as long as it did not negatively affect wilderness character or values. Impacts would be adverse, short- term, and localized due to cutting of vegetation and trampling by work crews. Overall, impacts on this vegetation community from thinning activities would be short- term, localized, and negligible to minor.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail using chainsaws and hand tools to cut down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. There are no fire management projects planned in this area, so fire suppression would be the only activity to consider in regard to cumulative effects. The restoration project and fire suppression activities included under Alternative 1 would result in adverse, short- term, minor to moderate as well beneficial, long- term, minor to moderate cumulative impacts on vegetation.

Conclusion
The impacts to vegetation communities would be adverse, short- term, and minor to moderate. There would also be beneficial, short and long- term, minor to moderate impacts. Cumulative impacts to vegetation would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long-term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis
Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

Prescribed Fire, WFURB, and fire suppression
Overall, impacts to vegetation communities would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. See "Impact Analysis Common to All Alternatives and All Vegetation Communities" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile Burning
The impacts to vegetation (including invasive non- native species) from pile burning under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and negligible to minor.

Thinning Activities

Pinyon- juniper savannas and woodlands and juniper- shrub grasslands: Impacts on this vegetation community from manual and mechanical thinning under Alternative 2 would be the same as under Alternative 1: no impacts.

Ponderosa pine savannas and forests and mixed conifer forests:

Under Alternative 2, impacts from thinning with hand tools and chain saws to ponderosa pine and mixed conifer forests in the WUI would be the same as under Alternative 1: localized and minor to moderate. Manual thinning would not occur in non- WUI, non- wilderness, except with approval from the Superintendent. Impacts would be negligible. In wilderness areas, thinning with hand tools would be allowed if it did not negatively affect wilderness character or values. As discussed under Alternative 1, it is unlikely that thinning with chain saws would have impacts on these vegetation communities in wilderness areas.

Overall, impacts on these vegetation communities from manual thinning activities would be adverse, short- term, and range from negligible to moderate, as well as beneficial, long- term, and negligible to minor.

Mechanical thinning under Alternative 2 includes low soil impactapparatus (such as hydromulchers) only. Mitigations as listed under Alternative 1 would be implemented. Under Alternative 2, mechanical thinning in ponderosa pine and mixed conifer forests would occur most aggressively in the WUI, producing minor to moderate localized impacts. These activities would not occur in non- WUI, non- wilderness, except in suppression and with approval from the Superintendent. Impacts would be negligible to minor. As discussed under Alternative 1, it is unlikely that mechanical thinning would have impacts on these vegetation communities in wilderness areas. Overall, impacts on these vegetation communities from mechanical thinning would be adverse, short- term, and range from negligible to minor, as well as beneficial, long- term, and minor to moderate.

Aspen:

Under Alternative 2, impacts of thinning with hand tools and chain saws on aspen in the WUI would be the same as under Alternative 1: minor. Most of the Monument's aspen clones are in non-WUI, non- wilderness areas (in the Cerro Grande area), where manual thinning activities would not occur under Alternative 2 because wilderness suitability has not been determined in this area. As discussed under Alternative 1, it is unlikely that manual thinning would have an impact on aspen in wilderness. Overall, impacts on aspen from manual thinning activities under Alternative 2 would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and negligible to minor.

Under Alternative 2, impacts of mechanical thinning on aspen in the WUI would be the same as under Alternative 1: minor. Most of the Monument's aspen clones are in non- WUI, non-wilderness (in the Cerro Grande area), where, under Alternative 2, mechanical thinning would not occur because wilderness suitability has not been determined. As discussed under Alternative 1, it is unlikely that mechanical thinning would have an impact on aspen in wilderness. Overall, impacts on aspen from mechanical thinning would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and negligible to minor.

Montane grasslands, wet meadows, and other grassland types:
Under Alternative 2, impacts of thinning with hand tools and chain saws on grasslands and meadows in the WUI would be the same as under Alternative 1: minor. A large portion of the Monument's grasslands and meadows are in non- WUI, non- wilderness, where, under Alternative 2, manual thinning would not occur unless with approval from the Superintendent. All of the Monument's montane grasslands are located in a non- WUI, non- wilderness area (Cerro Grande) where wilderness suitability has not been determined. Therefore, manual thinning would not occur in montane grasslands under Alternative 2 and there would be no impacts. As discussed under Alternative 1, it is unlikely that mechanical thinning would have an impact on grasslands in wilderness. Overall, impacts on grasslands and meadows from manual thinning under Alternative 2 would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and negligible to minor.

Under Alternative 2, impacts of mechanical thinning on grasslands and meadows in the WUI would be the same as under Alternative 1: minor. A large portion of the Monument's grasslands and meadows are in non- WUI, non- wilderness, where, under Alternative 2, mechanical thinning would not occur unless in suppression and with approval from the Superintendent. All of the Monument's montane grasslands are located in a non- WUI, non- wilderness area (Cerro Grande) where wilderness suitability has not been determined. Therefore, mechanical thinning would not occur in montane grasslands under Alternative 2 and impacts would be negligible. As discussed under Alternative 1, it is unlikely that mechanical thinning would have an impact on grasslands in wilderness. Overall, impacts on grasslands and meadows from mechanical thinning under Alternative 2 would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and negligible to minor.

Canyon riparian:
The impacts to this vegetation community from manual thinning with chain saws, manual thinning with hand tools, and mechanical thinning under Alternative 2 would be the same as under Alternative 1: adverse, short- term, localized, and minor.

Cumulative Impacts
Cumulative impacts under Alternative 2 would be the same as under Alternative 1, adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate.

Conclusion
The impacts to vegetation communities would be adverse, short- term, and range from negligible to moderate. There would also be beneficial, short and long- term, minor to moderate impacts. Cumulative impacts to vegetation would be adverse, short- term, and minor to moderate, as well as beneficial, long- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

WILDLIFE

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The analysis is based on existing inventory data, scientific literature, and information obtained through interdisciplinary team meetings, and an understanding of the effects of fire on wildlife species and critical habitat. Federally listed species and species of special concern are specifically addressed elsewhere. Thus, the analyses below apply only to species that have no special legal status.

The intensity and duration of effects are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Likely to result in a decrease in the abundance, diversity, and distribution of wildlife species. Changes could occur through direct disturbance or mortality, or through destruction or alteration of habitat.

Beneficial: Likely to protect, restore, or enhance the natural abundance, diversity, and distribution of wildlife species. This would occur through protection or restoration of the natural structure, succession, and distribution of habitat.

Duration of Impact

Short- term: Immediate changes in the abundance, diversity, and distribution of wildlife, but a return to the pre- disturbance condition within 20 years.

Long- term: Changes in the abundance, diversity, and distribution of wildlife that persist for more that 20 years.

Intensity of Impact

Negligible: Wildlife would not be affected or the effects would be short- term and at or below the level of detection, and the changes would not cause any measurable or perceptible consequence to the wildlife species' population.

Minor: Effects to wildlife would be detectable, but localized, and would be small and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would likely be effective.

Moderate: Effects to wildlife would be readily detectable, but localized and limited in extent. There may be consequences at the population level, but adverse impacts would eventually reverse. Mitigation measures, if needed to offset adverse effects, would likely be extensive and effective.

Major: Effects to wildlife would be obvious, long- term, and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse effects and their effectiveness would be unknown.

Impact Analysis Common to All Alternatives

Thinning Activities

The process of making physical changes to forest and woodland habitats from thinning activities would result in some adverse impacts to mammals, birds, reptiles, and amphibians. In general, thinning activities would likely alter physical vegetative cover and food supplies. Specifically, the removal of vegetative cover may make individuals more vulnerable to predation, just as the removal of plant material may decrease food availability. Human and noise disturbance would also adversely impact wildlife during thinning operations. Most individual animals have the ability to avoid adverse, short- term impacts from thinning activities by moving to adjacent areas. Individuals would likely relocate to nearby locations within a short period of time (hours or days), and may eventually return to thinned areas if food and cover are sufficient. Certain species that require denser, closed canopy habitat conditions may emigrate from the thinned area to more suitable habitat. Conversely, species that thrive in open canopy forest conditions may immigrate and colonize in newly thinned areas. The timing of implementation (e.g. inside or outside of the nesting/breeding season), the location of operations, the type of tool used in manual thinning, and use of low soil impactor high impact mechanical thinning apparatus would influence the intensity and duration of impacts to individual species. For instance, thinning activities within the nesting season may have relatively large impacts on certain nesting birds that cannot move to adjacent areas because of their ties to specific nesting areas. For this reason, mitigation measures call for the avoidance of some bird nesting seasons for thinning activities (See "Mitigation Measures Common to all Alternatives" in Chapter 2). Differences in tool usage, timing, and location of operations between alternatives and the subsequent potential effects to wildlife are discussed under each alternative below. However, in general, changes to forest and woodlands caused by thinning would likely have adverse, short- term, and negligible impacts to mammals, birds, and reptiles and amphibians in close proximity to thinning activities. Beneficial, long-term, minor to moderate impacts would result from the reduction of the potential for catastrophic stand replacing fires.

Prescribed Fire and WFURB

Prescribed fire and WFURB activities would have adverse, short- term, negligible to minor effects on mammals, birds, and reptiles and amphibians through direct injury and mortality. Most vertebrate species flee or seek refuge during fires, but some vertebrates are attracted to burning areas (Lyon et al., 2000a). Most fires have the potential to injure or kill

fauna, but lower intensity fires typical of prescribed burns and WFURB are less lethal to wildlife that have the ability to escape from fire. Animals with limited mobility are most vulnerable to fire caused injury and mortality (Lyon et al., 2000a). In addition, seasonality of burning is an important variable to direct injury and mortality rates of wildlife. Young nestlings found on the ground in low vegetation and small mammals with surface- level nests are most vulnerable to fire- induced injury and mortality (Lyon et al., 2000a). Mitigations, as described in Chapter 2, may limit prescribed fire and WFURB activities during certain breeding seasons to minimize these potential adverse impacts. Non- nesting birds would be able to leave the area would not likely be directly injured or killed. Most non- nesting small mammals at risk from prescribed fire and WFURB activities could also avoid direct harm by burrowing underground or seeking refuge in spaces under rocks and large dead wood. Some mortality of larger mammals, such as deer, coyotes, elk, and black bear have been reported in fires; however, this is most likely when fire is fast moving and actively crowning, with thick black ground smoke (Lyon et al., 2000a). These conditions would not be present under prescribed fire and WFURB activities at Bandelier. Adverse direct effects to reptiles and amphibians are generally not thought to be severe, despite the immobility of most of these species. This may be due, in part, to the mesic conditions required of most reptile and amphibians in this region (Lyon et al, 2000a).

Emigration and immigration of birds and mammals from fire may cause adverse, short-term, negligible to minor effects and beneficial, long- term, minor to moderate effects to wildlife species populations in Bandelier, depending on the structural habitat changes resulting from fire. For instance, bird populations may respond to changes in food, cover, and nesting habitat caused by fire (Lyon et al., 2000b). In general, some bird species would be adversely affected through the loss of habitat, while others would benefit through the addition of habitat. More specifically, some bird species may abandon burned areas because the habitat no longer provides the structure and food availability that is required for their survival (Lyon et al, 2000a). Conversely, some birds may be beneficially affected by freshly burned areas because food may be more abundant or more exposed than on unburned sites. For instance, some avian raptors and scavengers, such as the American kestrel, red- tailed hawk, Cooper's hawk, and turkey vulture may be attracted to fire or recently burned areas because of the reduction in hiding cover for prey (Dodd, 1988; Lehman and Allendorf, 1989; Lyon et al, 2000b). Overall, there may be some change in avian species composition within burned areas, but the net change in overall population composition and abundance within Bandelier would be negligibly affected by prescribed fire and WFURB activities.

Small mammals may also be beneficially affected by prescribed fire and WFURB and would likely quickly return or colonize recently burned areas because of the increased food supplies from post- fire herbaceous growth and seed availability. Large mammals would also return to burned areas primarily due to abundant food resources, and in the case of ungulates, greater visibility of predators (Lyon et al. 2004a).

Fire- caused changes in plant species composition and habitat structure influence reptile and amphibian populations; however for reasons not readily understood, many herptofaunal populations show little response to understory and mixed- severity fires

typical of prescribed burns and WFURB (Lyon et al., 2000b). Prescribed fire and WFURB would have adverse, short- term and negligible impacts to reptile and amphibian populations in Bandelier.

Beneficial impacts from prescribed fire and WFURB activities would be long- term and minor to moderate because of an overall increase in primary productivity of habitats as fire opens canopies and more sunlight reaches the ground. Greater primary productivity will translate into increased food production, increased herbaceous cover, and decreased risk of predation generally. In addition, fire- enhanced nutrient recycling will promote primary production and vigor of many plant species. Prescribed fires and WFURB would also serve to prevent intense, stand replacing fires that have the potential to cause significant mortality to wildlife.

Overall, prescribed fire and WFURB activities would likely have adverse, short- term, negligible to minor effects on wildlife. Beneficial effects would be long- term and minor to moderate.

Fire Suppression
Fire suppression activities would likely have adverse, short- term, negligible impacts to wildlife species in Bandelier. Suppression activities such fire line construction have the potential for ground disturbance, depending on the type equipment used. Hand digging fire lines may directly impact some burrowing rodents and ground dwelling birds, but direct mortality is unlikely if manual tools or low soil impactapparatus were used. These species would generally be able to move out of the area if necessary. Ground disturbance from locations of spike camps and helispots could adversely affect wildlife through destruction of some habitat, depending on the amount of ground disturbed. Slurry or chemical fire retardant gel drops have the potential to injure or kill wildlife through direct impact. Slurries or retardant gels would not likely be utilized in Bandelier, however, with Superintendent approval they could be part of an initial attack response in an emergency situation. Mitigation measures described in Chapter 2 would be employed to protect sensitive habitat during suppression operations. Overall, the effects from fire suppression on wildlife would be adverse, short- term, and negligible.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis
Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

Thinning Activities
Under Alternative 1, only manual thinning and low soil impactapparatus mechanical thinning would be allowed. Mitigation measures described in Chapter 2, under "Mitigation Measures Common to all Alternatives" would be employed under Alternative

1. Breeding season limitations may be implemented to reduce impacts to breeding birds from thinning activities, and sensitive habitat types may be avoided during operations. Adverse impacts from manual and mechanical thinning would be short- term and negligible. Beneficial impacts would be long- term and minor to moderate. See "Impact Analysis Common to All Alternatives" for a more detailed description of impacts from manual and mechanical thinning under Alternative 1.

Prescribed Fire, WFURB, and Fire Suppression
As discussed above, adverse impacts from these activities are expected to be short- term and range from negligible to minor. Beneficial impacts would be long- term and minor to moderate. See "Impact Analysis Common to All Alternatives" above for a more detailed discussion of the impacts of prescribed fire, WFURB, and fire suppression proposed under this alternative.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This action, when combined with fire management activities under Alternative 1 would have beneficial, long-term, negligible to minor cumulative effects on wildlife.

Conclusion
For thinning activities, adverse impacts to wildlife under Alternative 1 would be short- term and negligible. For prescribed fire and WFURB activities, adverse impacts would be short-term and negligible to minor. Adverse impacts from suppression activities would be short-term and negligible. For all activities, beneficial effects would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis
Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual

thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non- wilderness areas, except in suppression and with Superintendent approval.

Thinning Activities
Thinning activities proposed under Alternative 2 involve only manual thinning and low soil impact apparatus mechanical thinning. Impacts to wildlife from manual and mechanical thinning under Alternative 2 would be similar to those under Alternative 1 and "Impact Analysis Common to All Alternatives". However, under Alternative 2, manual and mechanical thinning would not be allowed in non- WUI, non- wilderness areas (approximately 5,500 acres) except with Superintendent approval. Impacts to wildlife from manual and mechanical thinning may be slightly reduced under this alternative due to the small reduction in acres where thinning is allowed. However, overall impacts to wildlife under this alternative would not change significantly from those described under Alternative 1 and "Impact Analysis Common to All Alternatives": adverse, short- term, and negligible.

Prescribed Fire, WFURB, and Fire Suppression
Under Alternative 2, impacts would be similar to those described under Alternative 1 and "Impact Analysis Common to All Alternatives".

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail using chainsaws and hand tools to cut down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This action, when combined with fire management activities under Alternative 2 would have beneficial, long- term, negligible to minor cumulative effects on wildlife.

Conclusion
For thinning activities, adverse impacts to wildlife under Alternative 2 would be short- term and negligible. For prescribed fire and WFURB activities, adverse impacts would be short- term and negligible to minor. Adverse impacts from suppression activities would be short- term and negligible. Beneficial impacts for all activities would be long- term and minor to moderate. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

SPECIAL STATUS SPECIES (WILDLIFE)

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The analysis is based on existing inventory data, scientific literature, and information obtained through interdisciplinary team meetings, and an understanding of the effects of fire on special status species. The intensity and duration of effects are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Likely to result in decreases in the abundance or distribution of a special- status species. This could occur through direct disturbance or mortality, or through destruction or alteration of habitat.

Beneficial: Likely to maintain or restore the natural abundance and distribution of a special-status species. This could occur through maintenance or restoration of structure, succession, and distribution of habitat.

Duration of Impact

Short- term: Immediate changes in the abundance and distribution of a special- status species, but a return to the pre- disturbance condition occurs within two generations of that species.

Long- term: Changes in the abundance and distribution of a special- status species that persist for more than two generations of that species.

Intensity of Impact

Negligible: No special status species would be affected or the alternative would affect an individual of a special status species or its critical habitat, but the change would not be of measurable or perceptible consequence to the protected individual or its population. Negligible effect would equate with a "no effect" determination for §7 Consultation with the U.S. Fish and Wildlife Service.

Minor: The alternative would affect an individual(s) of a special status species or its critical habitat, but the change would be small and limited in extent. Adverse impacts would reverse, and the resource would recover. Minor effect would equate with a "may effect, not likely to adversely affect" determination for §7 Consultation with the U.S. Fish and Wildlife Service.

Moderate: An individual or population of a special status species, or its critical habitat would be noticeably affected. The effect would be limited in extent, but could have some long- term consequence to the individual, population, or habitat. Adverse impacts

would eventually reverse, and the resource would recover. Moderate effect would equate with a "may effect" determination for §7 Consultation with the U.S. Fish and Wildlife Service and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species.

Major: An individual or population of a special status species, or its critical habitat, would be noticeably affected with long- term, vital consequences to the individual, population, or habitat. Adverse effects would not reverse without active management. Major effect would equate with a "may effect" determination for §7 Consultation with the U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species or critical habitat.

Table 4.1. Special status wildlife species likely to occur in Bandelier National Monument.

Common Name	Scientific Name	Federal Status[1]	State Status[2]
American peregrine falcon	***Falco peregrinus anatum***		**T**
Bald eagle	***Haliaeetus leucocephalis***	**LE**	**T**
Mexican spotted owl	***Strix occidentalis lucida***	**LT**	
Northern goshawk	***Accipter gentilis***	**SC**	
Goat Peak pika	***Ochotona princes nigrescens***	**SC**	
Spotted bat	***Euderma maculatum***		**T**
Townsend's big-eared bat	***Corynorhinus townsendii***	**SC**	
Jemez Mountains salamander	***Plethodon neomexicanus***		**E**

[1] Federal status under the ESA: LE = Endangered; LT = Threatened; C = Candidate for listing; SC = Species of Concern.

[2] State status: E = Endangered; T= Threatened; D = Taxa considered, but not included on above lists or was delisted from above lists.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Threatened and Endangered Species

Bald eagle

Impact Analysis

The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. The biological assessment for the 1997 FMP submitted to the United States Fish and Wildlife Service (USFWS) on September 15, 1995 details the anticipated impacts to bald eagles. It states that "Implementation of the [1997] FMP should not degrade and would likely enhance habitat for this species. Prey base would be expected to increase as a result of fire management activities. Fire management activities will be restricted in sensitive zones during critical time frames". The USFWS concurred with the National Park Service's determination that the 1997 FMP may affect, but would not likely adversely affect the bald eagle (USFWS 1995b).

Under Alternative 1, no prescribed fire or thinning activities are planned in bald eagle winter roosting habitat; however, WFURB would be allowed within all bald eagle winter roosting habitat in Bandelier. Adverse impacts to bald eagles from these activities are anticipated to be short- term and negligible to minor. Roosting bald eagles would be able to emigrate from the fire area and the risk of direct mortality is extremely low. Bald eagles would likely return to the area within the next year. Large diameter trees used for perching and roosting would survive a WFURB event, but some snags used by bald eagles may be lost. However, new snags and other habitat components would be created from fire mortality. To mitigate any potential adverse effects to bald eagles, a wildlife resource advisor would be consulted for any WFURB. Surveys for bald eagles may be conducted, and if roosting habitat is occupied, fire may be directed away from the area or be monitored to avoid destruction of critical roosting habitat components. Any WFURB would be evaluated for the potential to adversely affect bald eagles and would be extinguished if adverse effects are anticipated. All fire suppression activities in winter roosting habitat would follow the Minimum Impact Suppression Tactics for natural resources. Large diameter trees and snags used for perching and roosting would be avoided during construction of hand lines during any suppression efforts. Other mitigation measures as directed by the wildlife resource advisor would be evaluated and implemented as appropriate.

There may be beneficial, long- term, negligible to minor effects from fire management activities within foraging areas outside of canyon mouths by reducing the overall threat of stand replacing fire, providing a more open, navigable upland habitat, and potentially increasing upland prey resources for eagles within Bandelier, since bald eagles also eat upland small mammals and carrion (Zeiner et al. 1990).

Cumulative Impacts
There are no past, present, or future, foreseeable federal or non- federal activities currently planned within bald eagle winter roosting areas in Bandelier. However, the possible implementation of restoration activities within the pinyon- juniper vegetation community at Bandelier could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project, along with the activities associated with Alternative 1 would likely have a beneficial impact to bald eagles by providing more open upland habitat and promoting increased prey population densities within foraging areas. These beneficial cumulative impacts are anticipated to be negligible to minor in the long- term.

Conclusion
Implementation of the No Action Alternative, which involves maintaining the existing fire management plan, would not adversely affect the bald eagle in the long- term. Adverse impacts from WFURB activities would be short- term and negligible to minor. Beneficial impacts would be long- term, and negligible to minor. Cumulative impacts would be long- term and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Mexican spotted owl

Impact Analysis

The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. In 1998, a biological opinion (BO) (USFWS 1998) was issued by the USFWS for implementation of the 1997 FMP. Adverse effects of implementation on the Mexican spotted owl were analyzed in the BO. It states that " [n]egative effects to individual owls from fire may include disruption of owl breeding and/or foraging activities, direct harm from owls simply being flushed from a roost or a nest, owls abandoning nests, or owls being over- come with smoke or killed by flames or asphyxiation. However, beneficial aspects to the proposed action may include improved forage for the owls with respect to areas being burned (e.g., an increase in prey species, or improved vegetative conditions such that rodents are more accessible)".

The 1998 BO also identifies negative effects to Mexican spotted owl habitat, which may include the possible destruction of nesting/roosting habitat from a prescribed fire or WFURB fire becoming a wildfire. The effects would be adverse, short- term, and moderate in intensity. Beneficial effects to owl habitat may occur if fuel loading is reduced (minimizing the risk of catastrophic fire) and prey habitat is enhanced. These beneficial effects would be long- term and minor to moderate.

The USFWS determination presented in the 1998 BO was that the implementation of the 1997 FMP may affect, but would not likely to jeopardize the continued existence of the Mexican spotted owl. An incidental take permit was issued to the National Park Service for implementation of the 1997 FMP.

Surveys for Mexican spotted owls have been conducted in Bandelier since 1995. Individuals have been documented during 1995 - 2002. However, Mexican spotted owl surveys in 2003 and 2004 did not record any individuals within Bandelier. Based on historical occupancy, owls may return to Bandelier in the future and therefore effects identified in the 1998 BO must be considered.

Cumulative Effects

There are no past, present, or future, foreseeable federal or non- federal activities currently planned within suitable Mexican spotted owl SNAs and NRZs (as described in Chapter 3). However, the possible implementation of restoration activities within the pinyon- juniper vegetation community (outside of spotted owl SNAs and NRZs) at Bandelier could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project, along with the activities associated with Alternative 1 would likely have a beneficial impact to spotted owls by promoting increased prey population densities within foraging areas. These beneficial cumulative impacts are anticipated to be minor to moderate in the long- term.

Conclusion

Based on the biological assessment for the 1997 FMP and the 1998 USFWS BO, implementation of Alternative 1, may affect but would not jeopardize the continued existence of the Mexican spotted owl. The effects would include both adverse, short- term, moderate effects and beneficial, long- term, minor to moderate effects. Cumulative impacts are anticipated to be beneficial and minor to moderate in the long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National

Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Federal Species of Concern

Northern goshawk

Impact Analysis

The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. The biological assessment for the 1997 FMP submitted to the USFWS on September 15, 1995 details the anticipated impacts to northern goshawks. It states that implementation of the FMP "…should not degrade and would likely enhance suitable habitat, including prey base for this species." Adverse effects could result from smoke and human disturbance. Birds would likely be able to disperse from affected areas during thinning activities and prescribed or WFURB fires, and thus any direct mortality would be highly unlikely. Adverse effects from the No Action Alternative on the northern goshawk would be short- term and negligible to minor.

Activities that reduce the hazards of catastrophic fire and attain desired future conditions within ponderosa pine and mixed conifer vegetation communities are specifically recommended in Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds 1992). Effects from fire management activities on goshawk habitat would likely open canopy cover, decrease the density of small diameter trees, and increase population densities of prey species such as small mammals and birds. Goshawks utilize a wide range of successional forest conditions for foraging and may find an increased prey base as a result of fire management activities. Beneficial effects anticipated to be long- term and negligible to minor.

Cumulative Effects

There are no ongoing or future, foreseeable federal or non- federal activities currently planned within northern goshawk habitat in Bandelier. However, the possible implementation of restoration activities within the pinyon- juniper vegetation community at Bandelier could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project, along with the activities associated with Alternative 1, would likely have a beneficial impact to northern goshawk by promoting increased prey population densities within foraging areas. These cumulative impacts are anticipated to be negligible to minor in the long- term.

Conclusion

Adverse impacts of implementing the No Action Alternative on the northern goshawk are anticipated to be short- term and negligible to minor. Beneficial impacts are anticipated to be long- term and negligible to minor. Cumulative impacts are expected to be beneficial, long- term, and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Goat Peak pika
Impact Analysis
The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. The Goat Peak pika is endemic to the Jemez Mountains. Within Bandelier, this species can be found near Cerro Grande peak. Effects from fire management activities on Goat Peak pika habitat are likely to be adverse, short- term, and negligible due to the removal of grass forage and cover by prescribed fire, and beneficial and negligible to minor due to improved long- term quality and quantity of grass forage after prescribed fire.

Cumulative Effects
There are no ongoing or future, foreseeable federal or non- federal activities currently planned within Goat Peak pike habitat in Bandelier. Thus, no cumulative impacts to the Goat Peak pike are anticipated.

Conclusion
Adverse impacts of implementing the No Action Alternative on the Goat Peak pika are anticipated to be adverse, short- term, and negligible. Beneficial impacts are anticipated to be long- term and negligible to minor. No cumulative impacts are anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Townsend's big- eared bat
Impact Analysis
The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. This species is a cliff dweller and has diurnal roosts in cracks and crevices of cliffs and canyon walls (NMDFG 2004b). It is likely that fire management activities, such as thinning and burning, would have an adverse, short- term, negligible impact on this species from smoke and human disturbance. Bats would likely emigrate from the area in the short- term but activities would not cause permanent roost or hibernacula abandonment. Direct mortality to this species is highly unlikely. There would be beneficial, long- term, negligible to minor impacts on bat habitat because fire management activities would open canopy cover and increase insect prey base population densities within foraging areas.

Cumulative Effects
There are no ongoing or future, foreseeable federal or non- federal activities currently planned within big- eared bat habitat in Bandelier. However, the possible implementation of restoration activities within the pinyon- juniper vegetation community at Bandelier could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project, along with the activities associated with Alternative 1, would likely have a beneficial impact to spotted bat

by promoting increased insect prey population densities within foraging areas. These beneficial cumulative impacts are anticipated to be negligible to minor in the long- term.

Conclusion
Implementation of the No Action Alternative, which maintains the existing 1997 FMP, would likely have adverse, short- term, negligible impacts. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

State Listed Species

American peregrine falcon
Impact Analysis
The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. There may be adverse, short- term, negligible impacts to this species from human disturbance related to fire management. Birds would be able to emigrate from the area during thinning and fire operations, and mortality would be highly unlikely. Mitigations to reduce adverse impacts would include restrictions on fire management activities in sensitive zones during critical time frames (March 1 through August 15). There may be beneficial, long- term, and negligible to minor impacts to peregrine falcons from fire management activities under the existing plan due to opening of the canopy cover and a subsequent increase in prey populations.

Cumulative Effects
Other federal or non- federal past, present, and future foreseeable actions that could affect the peregrine falcon at Bandelier include the possible implementation of restoration activities within the pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. Cumulative effects from this project and the implementation of the No Action Alternative would be beneficial, long- term, and negligible to minor due to the opening of the canopy cover and subsequent increase in prey populations in foraging areas.

Conclusion
Adverse impacts on the peregrine falcon from implementation of Alternative 1, the No Action Alternative, would be short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts would be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National

Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Spotted bat

Impact Analysis

The No Action Alternative maintains the existing 1997 Bandelier Fire Management Plan. This species is a cliff dweller and has diurnal roosts in cracks and crevices of cliffs and canyon walls (NMDFG 2004c). It is likely that fire management activities, such as thinning and burning, would have an adverse, short- term, negligible impact on this species from smoke and human disturbance. Bats would likely emigrate from the area in the short- term but activities would not cause permanent roost abandonment. Direct mortality to this species is highly unlikely. Fire management activities would open canopy cover and increase prey population densities within foraging areas creating beneficial, long- term, minor impacts to the spotted bat.

Cumulative Effects

There are no ongoing or future, foreseeable federal or non- federal activities currently planned within spotted bat habitat in Bandelier. However, the possible implementation of restoration activities within the pinyon- juniper vegetation community at Bandelier could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project, along with the activities associated with Alternative 1, the No Action Alternative, would likely have a beneficial impact to spotted bat by promoting increased prey population densities within foraging areas. These cumulative impacts are anticipated to be minor in the long- term.

Conclusion

Implementation of the No Action Alternative would have adverse, short- term, negligible impacts. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Jemez Mountains salamander

Impact Analysis

The No Action Alternative maintains the existing Bandelier 1997 Fire Management Plan (FMP). The 1997 biological assessment for the FMP details the impacts on the Jemez Mountains salamander. It states that "[s]mall scale, short- term, adverse effects might occur, but would probably be limited to small pockets where heavy fuel accumulations or high stand densities result in the baking of soil or the removal of overstory; mortality of the individuals at these locations and under either of these conditions might be expected. However, abundant suitable and potential habitat exists for this species and only a small percentage would likely be consumed in any single prescribed fire." Thinning activities are anticipated to have a negligible adverse effect because only low soil impactmechanical apparatus would be used and most salamanders would be located below the ground during operations.

Prescribed fire and WFURB activities would include the following mitigation measures within suitable salamander habitat: 1) fire line will not be constructed through suitable habitat unless deemed absolutely necessary by fire personnel and a resource advisor during a wildfire situation(in the instance where it is deemed necessary to construct fire line through suitable habitat, natural barriers would be utilized as a first option in delimiting the burn unit); 2)minimal line construction techniques (i.e., removal of duff layer only) would be used as a last resort or as needed to link natural barriers; and 3) all fire line will be rehabilitated (i.e., by pulling the duff back onto the line) immediately after the fire is declared out. Thus impacts may be adverse, short- term, and negligible to minor from prescribed fire and WFURB activities.

Beneficial, long- term, minor to moderate impacts on salamander habitat would likely occur from prescribed fire and WFURB activities under this alternative. The majority of suitable habitat would likely be enhanced through a reinvigoration of stalled nutrient cycling processes, and an increase in available nutrients and soil microbial activity which typically increase post burn, benefiting ground dwelling arthropods which are the primary food prey for the Jemez Mountains salamander.

Cumulative Effects

There are no federal or non- federal future foreseeable actions that may occur within suitable salamander habitat. Therefore, no cumulative impacts to this species are anticipated.

Conclusion

Implementation of the No Action Alternative would likely have adverse, short- term, negligible to minor impacts on the Jemez Mountains salamander. Beneficial impacts would be long- term and minor to moderate. Cumulative impacts to this species under this alternative are not anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Threatened and Endangered Species

Bald eagle

Impact Analysis

Under Alternative 2, no prescribed fire or thinning activities are planned in bald eagle winter roosting habitat; however, WFURB would be allowed within all bald eagle winter roosting habitat in Bandelier. Adverse impacts to bald eagles from these activities are anticipated to be short- term and negligible to minor. Roosting bald eagles would be able to emigrate from the fire area and the risk of direct mortality is extremely low. Bald eagles would likely return to the area within the next year. Large diameter trees used for perching and roosting would survive a WFURB event, but some snags used by bald eagles may be lost. However, new snags and other habitat components would be created from fire mortality. To mitigate any potential adverse effects to bald eagles, a wildlife resource advisor would be consulted for any WFURB. Surveys for bald eagles may be conducted, and if roosting habitat is occupied, fire may be directed away from the area or be monitored to avoid destruction of critical roosting habitat components. Any WFURB would be evaluated for the potential to adversely affect bald eagles and would be extinguished if adverse effects are anticipated. All fire suppression activities in winter roosting habitat would follow the Minimum Impact Suppression Tactics for natural resources. Large diameter trees and snags used for perching and roosting would be avoided during construction of hand lines during any suppression efforts. Other mitigation measures as directed by the wildlife resource advisor would be evaluated and implemented as appropriate.

There may be beneficial, long- term, minor effects from fire management activities within foraging areas outside of canyon mouths by reducing the overall threat of stand replacing fire, providing a more open, navigable upland habitat, and potentially increasing upland prey resources for eagles within Bandelier, since bald eagles also eat upland small mammals and various type of carrion (Zeiner et al. 1990).

Cumulative Impacts

Under Alternative 2, cumulative impacts on the bald eagle would be similar to those described under Alternative 1, beneficial, long- term, and negligible to minor.

Conclusion

Implementation of Alternative 2 may affect, but would not adversely affect the bald eagle in the long- term. Adverse impacts from WFURB activities would be short- term and negligible to minor. Beneficial impacts would be long- term and minor. Cumulative impacts would be beneficial, long-term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Mexican spotted owl

Impact Analysis

Alternative 2 is designed to restore natural surface fires in known, suitable, and potential Mexican spotted owl nesting, roosting, and foraging habitat under conditions that will minimize the probability of continuous crown fire.

As stated in Chapter 3, Mexican spotted owls nest in canyons with a cool micro- environment and vegetation dominated by cool- moist habitat species typical of mixed- conifer forests in Bandelier. Fire prescriptions in high quality nesting habitat (occupied or unoccupied) would likely generate low- intensity surface fires. Owls located in mature overstory trees and in cliff nests would not be directly threatened by flames, although they could be affected temporarily by smoke. Roosting adults could easily move away from fire activity, and the risk of being killed by flames or asphyxiation would be insignificant (highly unlikely, and would never reach the point at which "take" of the species would occur). To further mitigate potential adverse effects to spotted owls, fire management activities within SNAs and NRZs would take place during the non- breeding season (1 September to 28 February). Spotted owls would be located prior to burning, and human activities would be controlled to prevent human disturbance. Only three people would be allowed within occupied SNAs to ignite a light underburn there, one of whom would be a USFWS-permitted spotted owl biologist. Within 600 m of an occupied SNA, use of chainsaws and aircraft would be restricted unless intervening topography attenuates the sound. In a noise study with spotted owls, the average alert response (head movements) to helicopters occurred a distance of 403 ± 148 m, with a maximum recorded distance of 660 m (Delaney and Grubb 1997). Reactions to chainsaw noise were similar. Measurements of sound attenuation from a mesa into a canyon indicate that attenuation of - 18 db is typical, which would reduce sound from 100 m beyond a rim to the loudness of a sound from the same source at least 800 m in a straight line. Therefore, restricting motorized activities closer than 600 m, or 100 m from canyon rims, and controlling non-motorized human activities, would mitigate potential adverse effects on spotted owls from noise disturbance.

Adverse impacts to spotted owl habitat may include the possible destruction of nesting and/or roosting habitat from prescribed fires or WFURB escaping prescription and becoming a wildfire. As stated in the 1998 BO for Bandelier's previous fire management plan, "[a] crown fire can quickly consume large areas and thus, habitat components for nesting, roosting, and foraging are reduced or eliminated." The mitigations stated in Chapter 2 under "Mitigations Common to All Alternatives" detail actions that would be employed to reduce the likelihood of intense or severe fires in spotted owl habitat. They include the following: 1) backing fires in SNAs would be used to limit the spread and intensity of fires; 2) where fuels are heavy and relatively dry, low density strip fires or spot fires would be used within SNAs; 3) SNAs would be treated at night using the appropriate firing pattern and direction, if conditions favor relatively intense fire behavior and undesirable effects; 4) surveys would be conducted to detect spotted owls and would cover designated nesting and roosting zones within 600 m of the planned burn during the year of the burn; 5) if spotted owls are detected, occupancy/reproductive status surveys would be conducted to determine the exact location of the owls and their reproductive status; 6) if spotted owls are nesting outside a mapped SNA, a new SNA would be established; 7) a spotted owl advisor would work directly with the 'Burn Boss' or other fire management team member in charge of operations on all prescribed fires that involve either an occupied SNA or an assumed occupancy NRZ; and 8) WFURB would be suppressed or constrained if undesirable disturbances to spotted owls or suitable habitat occur. In addition, spotted owl occupancy would be monitored before and after any fires within SNAs that take place outside of the breeding season. Photopoints would be

established in all SNAs to record before, immediately postburn, and 5 years post burn. Thus, any adverse impacts to owls and owl habitat from implementation of Alternative 2 are anticipated to be short- term and minor.

There may be beneficial long- term minor impacts to spotted owl habitat from implementation of Alternative 2. Scorch heights and structural changes in identified SNAs would likely be less than what occurred in two SNAs during the 1996 Dome wildfire, where owls successfully bred the next year. Ignition would be designed to reduce ground and ladder fuels within 3 m (10 ft) of the ground, while minimizing structural changes above that level. Within potential habitat in the NRZ, fire variability and the dampening effects of cool, moist microclimate in favorable situations are expected to maintain or even enhance some suitable nesting/roosting areas, just as it did in 1520 ha (76%) of the NRZ and 14 ha (74%) of the SNAs that were burned by the 1977 La Mesa and 1996 Dome wildfires. Much suitable nesting/roosting habitat survived burning under previous wildfire conditions, and more still would persist in the NRZ after moderate, prescribed burns have moved through these areas under less extreme weather conditions. Thus, any loss of suitable or potential nesting/roosting habitat would be insignificant.

The effects of moderate intensity prescribed burning in spotted owl foraging habitat would likely be beneficial, long- term, and minor to moderate. Higher occupancy and reproduction rates in the 1977 La Mesa Fire area have been evident, and are most likely due to greater prey abundance and diversity in burned foraging habitat. Long- term benefits of fire are also likely to outweigh any short- term detriments, as occupancy and reproduction in the 1977 La Mesa Fire area have consistently exceeded unburned areas, including the two- year period that began with the 1996 Dome Fire.

Significant disruption of spotted owl prey (rodents and small birds) availability is unlikely. Most prey species would survive prescribed fires by going underground. However, autumn fires may decrease prey abundance slightly more than breeding season burns, since herbaceous seed heads and structural cover will be consumed by the fire, and would probably not be regenerated until the following spring. During spring fires vegetation would recover relatively soon after a fire and provide food and cover for prey species. Most green grass and forbs in the burn area during a prescribed fire would not be able to burn. Prey availability is likely greater immediately after fire due to decreased cover and increased prey vulnerability, which could briefly benefit owls by increasing their food supply.

Cumulative Impacts
Cumulative effects on the Mexican spotted owl would be similar to those described under Alternative 1, beneficial, long- term, and negligible to minor.

Conclusion
Implementation of Alternative 2 may affect, but would not likely adversely affect the Mexican spotted owl in the long- term. Short- term adverse effects would be minor. Mitigations described above and in Chapter 2 under "Mitigation Measures Common to All Alternatives" would be implemented in order to minimize any adverse effects to the Mexican spotted owl. Beneficial effects would be long- term and minor to moderate. Cumulative effects would be beneficial, long-term and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Federal Species of Concern

Northern goshawk

Impact Analysis

Under Alternative 2, effects from prescribed fire and WFURB activities on the northern goshawk would be similar to those described above under Alternative 1, adverse, short- term, and negligible to minor. Beneficial impacts would be long- term and negligible to minor. Implementation of manual and mechanical thinning activities within suitable nesting goshawk habitat would take place outside of the breeding season (March 1 to August 15) to minimize any impacts to reproduction of the species.

Cumulative Impacts

Under Alternative 2, cumulative impacts to the northern goshawk would be similar to those described under Alternative 1, beneficial, long- term, and negligible to minor.

Conclusion

Adverse impacts from implementation of Alternative 2 on the northern goshawk would be similar to those described for Alternative 1, short- term and negligible to minor. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are expected to be beneficial, long-term, and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Goat Peak pika
Impact Analysis
The Goat Peak pika is endemic to the Jemez Mountains. Within Bandelier, this species can be found near Cerro Grande Peak. Under Alternative 2, fire management activities within suitable habitat for the pika would be the same as Alternative 1, and therefore adverse effects from fire management activities on Goat Peak pika habitat are likely to be similar, short- term and negligible due to the removal of grass forage and cover by prescribed fire and WFURB. Beneficial, long- term, negligible to minor impacts would occur do to the improved quantity and quality of grass forage after prescribed fire and WFURB.

Cumulative Impacts
As described under Alternative 1, there would be no cumulative impacts on the Goat Peak pika.

Conclusion
Implementation of Alternative 2 would have similar impacts on the Goat Peak pika as those described for Alternative 1, adverse, short- term, negligible impacts and long- term, negligible to minor beneficial impacts. No cumulative impacts are anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Townsend's Big- eared bat
Impact Analysis
Under Alternative 2, prescribed fire and WFURB activities and manual and mechanical thinning activities within suitable bat habitat are the same as Alternative 1 and may cause adverse, short-term, negligible impacts on Townsend's big- eared bats, as described under Alternative 1. Beneficial impacts would be long- term and negligible to minor.

Cumulative Impacts
Cumulative effects would be similar to those described above under Alternative 1, beneficial, long-term, and negligible to minor.

Conclusion
Implementation of Alternative 2 would have adverse impacts similar to those described under Alternative 1, short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other

relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

State Listed Species

American peregrine falcon

Impact Analysis

Under Alternative 2, fire management activities within suitable American peregrine falcon habitat would not change from Alternative 1. Therefore, adverse impacts would be similar to those described under Alternative 1, short- term, and negligible. Beneficial impacts would be long, term and negligible to minor.

Cumulative Impacts

Cumulative impacts under Alternative 2 would be similar to those described under Alternative 1, beneficial, long- term and negligible to minor.

Conclusion

Under Alternative 2, adverse impacts to the American peregrine falcon would be similar to those described under Alternative 1, short- term and negligible. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Spotted bat

Impact Analysis

Under Alternative 2, fire activities and manual and mechanical thinning activities in suitable spotted bat habitat are the same as Alternative 1 and would have impacts similar to those described under Alternative 1, adverse, short- term, and negligible. Beneficial impacts would be long- term and negligible to minor.

Cumulative Impacts

Cumulative effects would be similar to those described above under Alternative 1, beneficial, long-term, and negligible to minor.

Conclusion

Implementation of Alternative 2 would have adverse impacts on the spotted bat similar to those described under Alternative 1, short- term and negligible to minor. Beneficial impacts would be long- term and negligible to minor. Cumulative impacts are anticipated to be beneficial, long- term, and negligible to minor. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Jemez Mountains salamander

Impact Analysis

This species is near the surface only when summer conditions are moist and generally not suitable for prescribed fire and WFURB. Abundant suitable and potential habitat exists for this species and only a small percentage would likely be consumed in any single prescribed fire or WFURB. Under Alternative 2, adverse impacts on the Jemez Mountains salamander may occur, but would be similar to those described under Alternative 1, short- term and negligible to minor. Beneficial, long-term, minor to moderate impacts are also anticipated as described under Alternative 1. The majority of suitable habitat would likely be enhanced through a reinvigoration of stalled nutrient cycling processes, and an increase in available nutrients and soil microbial activity which typically increase post burn, benefiting ground dwelling arthropods which are the primary food prey for the Jemez Mountains salamander.

Cumulative Impacts

As described under Alternative 1, there would be no cumulative impacts on the Jemez Mountains salamander.

Conclusion

Alternative 2 would likely have adverse impacts similar to those described under Alternative 1, short- term and negligible to minor. Beneficial impacts would be long- term and minor to moderate. Cumulative impacts to this species under this alternative are not anticipated. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

SPECIAL STATUS SPECIES (PLANTS)

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. A comprehensive floristic inventory of Bandelier was conducted in the late 1980's by the Monument botanist who has continued to document new species and monitor known sensitive plant populations during the last 15 years. There are currently no federally listed plant species known or expected to occur within the boundaries of Bandelier. There are two state listed endangered species and the Monument botanist has identified two additional species of concern for consideration in this EA. The information presented below is derived from unpublished reports, research and monitoring data, and incorporates observations of the sensitive plant species and habitat by the Monument botanist. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Viability of known populations and/or potential habitats of special- status species are threatened. May lead to loss of habitat, increased competition by both native and non- native species, or reduce and/or prevent reproduction.

Beneficial: Habitat conditions would be improved and the viability of the populations would be enhanced. Competitive species may be eliminated, thereby increasing available habitat, or improving reproductive output and success.

Duration of Impact

Short- term: May immediately affect the population or species, but with no long- term effects to population trends or species viability.

Long- term: May lead to a loss in population or species viability—exhibited by a trend suggesting decline in overall species abundance, viability, and/or survival.

Intensity of Impact

Negligible: No federally listed species would be affected or the alternative would affect an individual of a listed species or its critical habitat, but the change would not be of measurable or perceptible consequence to the protected individual or its population. Negligible effect would equate with a "no effect" determination in U.S. Fish and Wildlife Service terms.

Minor: The alternative would affect an individual(s) of a listed species or its critical habitat, but the change would be small and localized. Minor effect would equate with a "may effect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species.

Moderate: An individual or population of a listed species, or its critical habitat would be noticeably affected (e.g. a change in abundance, distribution, quantity, or quality).

The effect could have some long- term consequence to the individual, population, or habitat. Moderate effect would equate with a "may effect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species.

Major: An individual or population of a listed species, or its critical habitat, would be noticeably affected with a long- term, landscape scale, vital consequence to the individual, population, or habitat. Major effect would equate with a "may effect" determination in U.S. Fish and Wildlife Service terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species or critical habitat.

Impact Analysis Common to All Alternatives

Gramma grass cactus (*Pediocactus papyracanthus*)
This species has been identified as a species of concern by the Monument botanist. It is documented in Bandelier and suitable habitat has been identified. Habitat for this species is characterized by relatively open, grassy pinyon- juniper woodlands of gentle slope and usually in proximity to basaltic canyon rims. Fire appears to be of rare occurrence given absence of fire scars and insufficient surface fuels. Major woodland restoration efforts would be required on most pinyon- juniper woodland sites before sufficient surface fuels were available to carry a fire; thus the current habitat for this species is largely outside of the scope of the fire management alternatives. Therefore, fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under all alternatives would likely have adverse, short- term, and negligible effects on suitable or potential habitat for this species.

Yellow lady slipper *(Cypripedium calcelous)*, grape fern *(Botrychium virginianum)*, and wood lily *(Lilium umbellatum)*
The yellow lady slipper, grape fern, and wood lily occur in the upper reaches of Frijoles Canyon and are restricted to boggy, wetland, or riparian areas within the canyon. Therefore, the impact analysis has been completed for these species as a group. Below is a brief description of each species and the role fire plays in maintaining their habitat:

Yellow lady slipper, *Cypripedium calcelous:*
This state listed endangered species has been documented in Bandelier and suitable habitat exists. This species prefers moist, and somewhat open, grassy understories in mixed coniferous forests of mesic canyon bottoms. Maintenance of this open, grassy habitat would appear to require periodic fire events and many of the current populations grow in or near spot fires dating to the 1977 La Mesa Fire.

Grape fern, *Botrychium virginianum:*
This species has been identified as a species of concern by the Monument botanist. It has been documented in Bandelier and suitable habitat exists. This species prefers moist, usually boggy, and somewhat open understories in mixed coniferous forests of mesic canyon bottoms. The role of fire in maintaining habitat for this species is unclear, but this species co- occurs with the yellow lady slipper.

Wood lily, *Lilium umbellatum:*

This state listed endangered species has been documented in Bandelier and suitable habitat exists. This species prefers moist, and somewhat open, grassy understories in mixed coniferous forests of mesic canyon bottoms. Maintenance of this open, grassy habitat would appear to require periodic fire events.

Maintenance of plant diversity and protection of the above sensitive plant species are compatible goals with an integrated fire management program that uses a combination of tools to manage fire dependent systems. Where these sensitive species live within the context of fire dependent systems, it is reasonable to conclude that they derive longer term benefits from periodic fire disturbance which enhances, maintains, and creates their habitat. In the absence of periodic fire disturbance, woody plant densities generally increase and may shade or out- compete herbaceous vegetation including these sensitive plant species. With excessive crown closure, woodlands and forests become vulnerable to crown fire which may result in long- term loss of habitat where these sensitive species exist. While the short- term effects of individual fire events can cause random mortality of individuals and negatively affect small pockets of suitable habitat for these species, properly managed fire disturbance can minimize these short- term impacts and support long- term maintenance of their habitat. In summary, the impacts to these species would be adverse, short-term, and minor to moderate as well as beneficial, long- term, and minor to moderate.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument. Specific, detailed mitigations related to special status species are included under this alternative.

Gramma grass cactus*, (Pediocactus papyracanthus):*
See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under this alternative.

Yellow lady slipper *(Cypripedium calcelous),* grape fern *(Botrychium virginianum),* and wood lily *(Lilium umbellatum)*

Please see "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire and WFURB as proposed under this alternative.

Fire suppression and moderate manual thinning activities as proposed under Alternative 1 should not degrade the suitable and potential habitat for these species if the following mitigation measures under this fire management plan are successful:

1a. Where possible, avoid ground disturbing activities such as line construction, manual or mechanical treatments, or pile burning in areas of known special status plant populations and in areas of suitable habitat (which includes moist, somewhat open, grassy understories in mixed coniferous forests of mesic canyon bottoms and relatively open, grassy pinyon- juniper woodlands of gentle slope, usually in proximity to basaltic canyon rims).

1b. Prohibit trail widening, trail anchored line construction, and canyon bottom line construction above Alcove House because most of the special status plant species occur immediately adjacent to or near the existing trail in Frijoles Canyon.

1c. Only in emergency situations, construct fire line through suitable habitat by using natural barriers such as the stream bed to delimit the burn area. As a last resort, if no natural barriers exist, construct fire line by using minimal line construction techniques (i.e., removal of duff layer only) to link natural barriers. Rehabilitate all fire line by pulling the duff back onto the line after the fire is declared out.

2) Monitor special status plant response to fire management activities.

It is likely that these mitigation measures would be successful under the moderate thinning activities included in Alternative 1. However, there would still be potential for adverse, short- term, minor to moderate effects caused by constructing fire lines, chainsaw use, and ground disturbance caused by workers. Mechanical thinning would not pose any risk to these species because they exist in moist canyon bottoms, where there is no access for thinning machinery.

Cumulative Impacts

Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project and the fire management activities proposed under Alternative 1 would result in cumulative impacts on the gramma grass cactus that are adverse, short- term, negligible to minor as well as beneficial, long- term, and minor because suitable habitat for this species is the pinyon- juniper woodlands. There would be no cumulative impacts associated with the yellow lady slipper, grape fern, and wood lily because they are restricted to moist canyon bottoms.

Conclusion
Impacts to the gramma grass cactus from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 1 would likely be beneficial and adverse, short- term, and negligible. Impacts to the yellow lady slipper, grape fern, and wood lily would be adverse, short- term, and minor to moderate. There would also be beneficial, long- term, minor to moderate impacts from maintenance or creation of suitable habitat. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Cumulative impacts to the gramma grass cactus would be adverse, short- term, and negligible to minor as well as beneficial, long- term, and minor. There would be no cumulative impacts associated with the yellow lady slipper, grape fern, and wood lily.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non- wilderness areas, except in suppression and with Superintendent approval. Specific, detailed mitigations related to special status species are included under this alternative.

Gramma grass cactus, *Pediocactus papyracanthus):*
See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under this alternative.

Yellow lady slipper *(Cypripedium calcelous)*, grape fern *(Botrychium virginianum),* and wood lily *(Lilium umbellatum)*
Please see "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire and WFURB as proposed under this alternative.

Fire suppression and limited manual thinning activities as proposed under Alternative 2 would not degrade the suitable and potential habitat for these species because activities will be mitigated in or near known populations (see mitigations under Alternative 1). These mitigation measures would be successful under the limited thinning activities included in Alternative 2. Impacts would therefore be adverse, short- term, and negligible to minor. Mechanical thinning would not pose any risk to these species because they exist in moist canyon bottoms, where there is no access for thinning machinery.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project and the fire management activities proposed under Alternative 2 would result in adverse, short- term, negligible to minor as well as beneficial, long- term, minor cumulative impacts on the gramma grass cactus because pinyon- juniper woodlands are suitable habitat for this species. There would be no cumulative impacts associated with the yellow lady slipper, grape fern, and wood lily because they are restricted to moist canyon bottoms.

Conclusion
Impacts to the gramma grass cactus from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 2 would likely be beneficial and adverse, short- term, and negligible. Impacts to the yellow lady slipper, grape fern, and wood lily would be adverse, short- term, and negligible to minor. There would also be beneficial, long- term, minor to moderate impacts from maintenance or creation of suitable habitat. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Cumulative impacts to the gramma grass cactus would be adverse, short- term, and negligible as well as beneficial, long- term, and minor. There would be no cumulative impacts associated with the yellow lady slipper, grape fern, and wood lily.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

PHYSICAL ENVIRONMENT

SOILS AND WATER RESOURCES

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The area of analysis includes soil and water resources within Bandelier National Monument. Because these two topics are interrelated in their reactions to the treatments proposed in the alternatives, a combined analysis was completed. This analysis is based on scientific literature and an understanding of the effects of fire on soils and water resources. Topics considered in the soil analysis are nutrient cycling, microbial communities, erosion, light penetration, soil hydrophobicity, and soil compaction. Topics considered in the water resources analysis are sediment yield, nutrient yield, water yield, peak flows, stream/channel response, and riparian systems. The intensity of effects and impact durations are discussed in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Moves the system outside of or away from the natural range of variability for soils (productivity, fertility) and watershed conditions (water yield, peak flows, sediment yield, nutrient yield, or stream system response).

Beneficial: Moves the system toward or maintains it within the natural range of variability for soils (productivity and fertility) and watershed conditions (water yield, peak flows, sediment yield, nutrient yield, or stream system response).

Duration of Impact

Short- term: Following treatment, recovery would take less than 20 years.

Long- term: Following treatment, recovery would take more than 20 years.

Intensity of Impact

Negligible: Soils and water resources would not be affected, or changes would be either undetectable or if detected, would have effects that would be considered slight and local. No mitigations to offset adverse impacts would be necessary.

Minor: The effects to soils and water resources would be measurable, but changes would be small and localized. Few mitigation measures would be needed and they would likely be successful. No mitigation measure associated with water resources would be necessary.

Moderate: The effect on soils would be readily apparent and result in a change in soil structure and /or function over a relatively wide area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful. Changes in water

resources would be measurable, but relatively local. Mitigation measures associated with water resources would be necessary and would likely succeed.

Major: The effect on soils would be readily apparent and would substantially change the structure and function of soils over a large area in and out of the Monument. Mitigation measures to offset adverse effects would be needed, extensive, and their success would be unknown. Changes in water resources would be readily measurable, with substantial consequences, and would be measurable on a regional scale. Mitigation measures would be necessary and their success would be unknown.

Impacts Analysis Common to All Alternatives

Prescribed Fire and WFURB

Soils - Fire affects nutrient cycling directly by causing soil nutrients to change in composition, distribution, and amount. These changes are from the release of elements during combustion of fuel and organic matter. Carbon and nitrogen, and to a lesser extent sulfur and phosphorus, are most readily lost. Fire converts these nutrients, normally bound in organic matter, to a form that is available to plants. However, high intensity fire can actually cause a decrease in the total soil nutrient content at a site because many of the nutrients are removed through fly- ash or via a strong convection column. Conversely, in low intensity prescribed fires and WFURB, many of the nutrients remain on- site and are available for plants (Kimmins, 1997).

Fire also affects nutrient cycling indirectly by changing the environmental constraints, such as soil moisture, temperature, and pH, on the microbial populations. In general, microbial communities are influenced by the warmer soil temperatures, variable moisture levels, higher pH levels, and altered organic carbon sources that can result after fire (Kimmins, 1997). In most cases, the number of soil micro- organisms is reduced after fire. However, many of the species found in microbial communities tend to be functionally redundant, serving the same role in the function of the community. If the number of soil micro- organisms is reduced after fire, but the diversity of species is preserved, the resilience of the system can be maintained (Schutter, 2003). In addition, soil micro- organisms are usually able to quickly re- colonize a burned area due to the mobility of their reproductive propagules (Kimmins, 1997).

Fire can increase the potential for erosion by removing vegetation, litter, and duff (exposing mineral soil) and by altering the physical properties of soil, such as water holding capacity, porosity, and infiltration rates (Wright and Bailey, 1982). Generally, the more severe a fire, the greater its effects will be. Under prescribed and managed conditions (WFURB), fire intensity can be controlled to minimize the exposure of mineral soil and lessen the effects on soil physical properties. In general, low intensity fire does not significantly alter soil physical properties over a large area (Wright and Bailey, 1982), and has the benefit of removing moderate amounts of vegetation, litter, and duff, which increases the penetration of solar radiation and stimulates seed germination in many plants.

When organic compounds are vaporized during a fire, they can distill downward into the soil and form a water repellent, or hydrophobic, layer. This hydrophobic layer reduces the rate of water infiltration into the underlying mineral soil (Wright and Bailey, 1982). Prescribed fires and WFURB burn under variable conditions and create a mosaic of burned and unburned patches, eliminating widespread areas of hydrophobic soils.

In both prescribed fires and WFURB, fire would generally move through the litter and duff layers with low intensity. In patches of higher fuel loading, fire intensity would be greater. These variable conditions would result in fires that range from light to locally severe. To ensure that locally severe fires do not result in significant adverse impacts to soils, the following mitigation measures would be implemented under each alternative (see Chapter 2: "Mitigation Measures Common to All Alternatives" for a detailed description of each mitigation measure):

- Mulching
- Aerial or hand seeding with native plants
- Contour felling and bucking of small trees or using straw wattles
- Slashing by felling, lopping, limbing, and scattering of trees
- Sand/soil bags and trenching
- Rock and log grade stabilizers
- Check dams constructed with rock, fence, logs, straw bales, or straw wattles
- Raking of soil

Considering these mitigation measures and the fire effects information provided above, the impacts of prescribed fire and WFURB on soils would be beneficial, short and long- term, and range from negligible to moderate as well as adverse, short- term, and negligible to minor.

Water Resources - Because fire can increase rates of erosion and overland flow, it can affect water resources through sediment loading and increased turbidity. Fire also causes rapid mineralization and mobilization of nutrients, which can become concentrated in overland flow, causing nutrient loading downstream (Wright and Bailey, 1982). Hydrologic processes, such as water yield and peak flows, can increase following fire because soil infiltration rates decrease and there is less vegetation to slow water run- off and intercept precipitation. This increase in water yield and peak flow can produce various channel responses, such as widening or changing the course of streams. Riparian communities can be affected by these channel responses. As described with soils, the more severe and large a fire, the greater its effects will be on water resources.

Under prescribed and managed conditions (WFURB), fire intensity can be controlled so that fire would generally move across watersheds in the litter and duff layers with low intensity. However, in local patches of higher fuel loading, fire intensity would be greater. Patches of hydrophobic soils may be created in these areas, where soils would be exposed to heating for a longer period of time than in areas with lighter fuels. As a result of the patches of hydrophobic soils and increased erosion caused by fire, water yield and peak flows may increase resulting in adverse impacts to water resources, but only slightly, so there would be negligible to minor channel response and a short- term recovery of riparian systems. Increased sediment and nutrient yield fluctuations would also be short- term and generally watershed specific, therefore negligible. Prescribed fire and WFURB impacts would also be beneficial in the short and long- term, as these fire actions would be used to reduce the severity of future fires and to limit the potential for catastrophic fire that could burn along both sides of the vertical gradients in watersheds.

Along with the soil mitigations listed above, the following water resources mitigations will be implemented under each alternative:

- Proportion of steep slopes burned in a watershed will be minimized.
- Burns that are continuous up both sides of the vertical gradient of a watershed will be avoided.
- Thinning activities will be conducted at least 200 ft. from stream.

The magnitude and longevity of fire effects on soils and water resources depend on many factors including fire regime, severity of a particular fire, vegetation and soil type, topography, season of burning, and pre- and post- fire weather conditions.

Fire Suppression
Fire suppression activities, such as removing live and dead vegetation, constructing fire line, locating helispots and spike camps, and conducting mop up can disturb surface vegetation and soils, possibly contributing to erosion and soil compaction. Erosion is usually greatest along disturbed areas, such as fire lines, that follow steep gradients. As discussed above under "Prescribed fire and WFURB", increased erosion can reduce soil productivity and function and cause sediment loading, which can negatively affect water resources. Soil compaction would be greatest with helispots and spike camps. Helispots cover a relatively small surface area and would typically have negligible effects on soils and water resources. Spike camps have the potential to affect a larger surface area, but impacts would still be negligible to minor.

In general, the effects of the above fire suppression activities would be adverse and short- term and would not have substantial effects on soils or water resources, unless unmitigated. Under each alternative, the above soils and water resources mitigation measures would be implemented and firefighters would also refer to the Minimum Impact Suppression Tactics guide (see Appendix D).

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis
Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument. Specific, detailed mitigations related to soils and water resources are included under this alternative.

Prescribed Fire, WFURB, and fire suppression
Impacts to soils and water resources would be beneficial, short and long- term, and range from negligible to moderate as well as adverse, short- term, and negligible to minor. See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile Burning
Piles of live and dead fuels would generally burn much hotter than broadcast prescribed fire and WFURB. They would create patches of moderately to severely burned soils where physical, chemical, and biological characteristics would be expected to substantially change. The soil in these areas may also become hydrophobic. However, because these patches would be relatively small and pile burning under Alternative 1 would be used only moderately, the biological function of soil in the patches would quickly return and impacts to soils would be adverse, short- term, and minor.

The effects of pile burning would not be on a watershed scale under this alternative. It is unlikely that water yield and peak flows would noticeably increase, so there would be little to no channel response and negligible effects on riparian systems. Sediment and nutrient yield fluctuations, if any,

would be short- term and watershed specific. In summary, impacts would be adverse, short- term, and negligible.

Thinning Activities
Thinning with hand tools or chain saws (manual thinning) could lead to soil compaction on a localized scale, but adverse impacts would be short- term and negligible. Impacts to water resources, if any, would be adverse, short- term, and negligible.

Mechanical thinning activities would occur in the WUI and in non- WUI/non- wilderness areas under this alternative. This covers approximately less than 10,000 acres of the Monument. No dozers would be allowed in the Monument and the following mitigations would be implemented:

- Minimize the effects of soil compaction due to mechanical thinning activities by spreading slash on the ground.
- Conduct mechanical thinning activities during winter months when the soil is frozen.
- Rake appropriate areas after mechanical treatments.

The use of heavy machinery can alter soil structure, porosity, density, and infiltration capacity, as well as other properties. The degree of alteration depends on the weight of the machinery and the intensity of use. Mechanical thinning under Alternative 1 is likely to cause soil compaction and increase rates of erosion. However, dozers are not allowed in the Monument and soil mitigation measures are likely to be successful. Mechanical thinning activities could affect water resources by increasing sediment yield, nutrient yield, water yield, and peak flows, resulting in channel response and impacts to riparian communities. Again, mitigation measures are likely to be successful. Mechanical treatments under this alternative will be used in combination with prescribed burning and WFURB to reduce the potential for large, high- severity fire over the long- term, thereby reducing the potential for soil and watershed impacts. Therefore, impacts to soils and water resources from mechanical thinning would be beneficial, long- term, and minor to moderate as well as adverse, short- term, and minor to moderate.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This project and the fire suppression activities proposed under Alternative 1 would result in adverse, short- term, and negligible to minor cumulative impacts on soils. There would be adverse, short- term, negligible cumulative impacts to water resources. There would also be beneficial, long- term, minor to moderate cumulative impacts to soils and water resources due to the reduction of soil erosion.

Conclusion
Impacts to soils and water resources from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 1 would likely be adverse, short- term, and range from negligible to moderate. There would also be beneficial, short and long- term, negligible to moderate impacts. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Cumulative impacts to soils would be adverse, short- term, and negligible to minor. Cumulative impacts to water resources would be adverse, short- term, and negligible. There would also be

beneficial, long- term, minor to moderate cumulative impacts to soils and water resources due to the reduction of soil erosion. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non- wilderness areas, except in suppression and with Superintendent approval. Specific, detailed mitigations related to soils and water resources are included under this alternative.

Prescribed Fire, WFURB, and fire suppression

Impacts to soils and water resources would be beneficial, short and long- term, and range from negligible to moderate as well as adverse, short- term, and negligible to minor. See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile Burning

Impacts to soils and water resources from pile burning under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and negligible to minor.

Thinning Activities

Impacts to soils and water resources from manual thinning activities under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and negligible.

Mechanical thinning activities under this alternative would be allowed in the WUI (covering 1,226 acres) and conducted with low soil impactapparatus only. Mechanical thinning would not be allowed in the non- WUI, non- wilderness, except in suppression and with Superintendent approval.

Although the use of heavy machinery can alter soil structure, porosity, density, and infiltration capacity, as well as other properties, the limited extent (1,226 acres) of mechanical thinning under this alternative and the expected success of the mitigation measures (listed under Alternative 1) would result in negligible impacts to soils. It is not likely that sediment yield, nutrient yield, water yield, peak flows, channel response and riparian communities would be adversely affected. Therefore, impacts to soils and water resources from mechanical thinning under Alternative 2 would be adverse, short- term, and negligible as well as beneficial, long- term, and minor.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community (See Alternative 1 for a more detailed description of this project). This project and the fire suppression activities proposed under Alternative 2 would result in adverse, short- term, and negligible to minor cumulative impacts on soils. There would be adverse, short- term, negligible cumulative impacts to water resources. There would also be beneficial, long- term, minor to moderate impacts to soils and water resources due to the reduction of soil erosion.

Conclusion
Impacts to soils and water resources from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 2 would likely be adverse, short-term, and range from negligible to minor. There would also be beneficial, short and long- term, negligible to moderate impacts. Cumulative impacts to soils would be adverse, short- term, and negligible to minor. Cumulative impacts to water resources would be adverse, short- term, and negligible. There would also be beneficial, long- term, minor to moderate impacts to soils and water resources due to the reduction of soil erosion. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

AIR QUALITY

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided below. The area of analysis for this topic includes Bandelier National Monument and the surrounding area. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Increases emissions or raises pollutant concentrations.

Beneficial: Reduces emissions or lowers pollutant concentrations.

Duration of Impact

Short- term: Associated with the duration of a specific fire management treatment event.

Long- term: Lasts longer than the treatment event.

Intensity of Impact

Negligible: No changes would occur or changes in air quality would be below or at the level of detection, and if detected, would have effects that would be considered slight. No air quality mitigation measures would be necessary.

Minor: Changes in air quality would be measurable, although the changes would be small, short- term, and the effects would be localized. No air quality mitigation measures would be necessary.

Moderate: Changes in air quality would be measurable, and would have consequences, although the effect would be local to regional. Air quality mitigation measures would be necessary and the measures would likely be successful.

Major: Changes in air quality would be measurable, would have substantial consequences, and be noticed regionally. Air quality mitigation measures would be necessary and the success of the measures would be unknown.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

Manual and mechanical thinning would have an adverse, short- term, and localized effect from dust emissions that would be negligible to minor. Both prescribed fire and WFURB can result in adverse, short- term air quality impacts that are minor to moderate. Smoke emissions from burning indirectly affect visibility and public health on an episodic basis. The following mitigation measures to be carried out under this alternative would minimize smoke and ensure that impacts are short-term and minor to moderate: 1) All prescribed burning and pile burning will comply with State of New Mexico air quality guidelines and smoke management regulations. These regulations aim to ensure that burning is conducted under favorable atmospheric conditions so that smoke does not become concentrated and affect public health or visibility. 2) A site- specific prescribed burn plan will be prepared for each project and will include all of the required elements related to air quality in RM- 18. 3) Monument staff will monitor air quality adjacent to project areas and within developed areas of the Monument. Unhealthy or hazardous accumulations of smoke will trigger an aggressive suppression action that will continue until the air quality attains acceptable levels, or the fire is out. 4) When adjacent land management agencies are managing prescribed fires or wildland fires, cooperation and coordination will be initiated to minimize cumulative smoke impacts. Even without the implementation of the above mitigation measures, moderate adverse effects would decrease to minor levels as fuel levels are slowly reduced over time.

On a regional basis, effects to air quality would generally be adverse, short- term, and minor to moderate, as large quantities of pollutants, primarily particulates, are released to the atmosphere and travel past the Monument boundaries during prescribed fires or WFURB. Indirect effects from these air emissions would include the possible reduction in visibility along roadways, reductions in recreation values due to visibility limitations, smoke and odors, and possible health effects to sensitive residents and visitors.

Cumulative Impacts

Cumulative impacts with regard to manual and mechanical thinning and other sources of particulate would be adverse, short- term, localized, and negligible to minor.

Cumulative impacts to local and regional air quality from fire activities could result when combined with: 1) smoke from other fires originating in the surrounding state and national forests, 2) haze from regional sources, and 3) minor emissions from maintenance and other activities in the Monument. By and large, the air quality in the region is quite good, so these background contributions would be negligible except for rare episodes. Hence, the combined effects would still result in adverse, short- term, minor to moderate, direct and indirect effects to air quality, visibility, and human health. The severity and duration of impacts would largely depend on the extent of fires in the area and whether or not they occurred at the same time. Coordination with other agencies would help to minimize these cumulative impacts.

Conclusion
Effects from thinning activities under Alternative 1 would be adverse, short- term, localized, and negligible to minor. Fire activities would result in adverse, short- term, minor to moderate impacts to air quality and air quality- related values due to emissions of air pollutants, smoke, and odors. Cumulative impacts due to thinning activities would be adverse, short- term, and negligible to minor. Cumulative impacts due to fire activities would be adverse, short- term, and minor to moderate.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis
Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

Under Alternative 2, manual and mechanical thinning are more limited than under Alternative 1, and thus would generally produce lower levels of dust emissions. These effects would most likely be adverse, short- term, localized, and negligible.

Impacts to air quality from prescribed fire and WFURB would be the same as under Alternative 1: adverse, short- term, and minor to moderate. Mitigations to be carried out under this alternative are the same as under Alternative 1.

Cumulative Impacts
Cumulative impacts with regard to manual and mechanical thinning and other sources of particulate would be adverse, short- term, localized, and negligible. Cumulative impacts with regard to fire activities under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and minor to moderate.

Conclusion
Effects from thinning activities under Alternative 2 would be adverse, short- term, localized, and negligible. Fire activities would result in adverse, short- term, minor to moderate impacts to air quality and air quality- related values due to emissions of air pollutants, smoke, and odors. Cumulative impacts due to thinning activities would be adverse, short- term, and negligible. Cumulative impacts due to fire activities would be adverse, short- term, and minor to moderate.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National

Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

CULTURAL ENVIRONMENT

Impacts to Cultural Resources and §106 of the National Historic Preservation Act

In this Environmental Assessment/ Assessment of Effect, impacts to archeological resources, ethnographic resources, cultural landscape resources, and historical resources are described in terms of type, duration, and intensity, which is consistent with the regulations of CEQ that implement NEPA. These impact analyses are intended, however, to comply with the requirements of both NEPA and §106 of the National Historic Preservation Act (NHPA). In accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources were identified and evaluated by 1) determining the area of potential effects; 2) identifying cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the National Register of Historic Places; 3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and 4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected cultural resources eligible for the National Register. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualify it for inclusion in the National Register (e.g., diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CFR Part 800.5, *Assessment of Adverse Effects*). A determination of *no adverse effect* means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

CEQ regulations and the National Park Service's Director's Order #12 (NPS 2001c) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). However, any resultant reduction in intensity of impact due to mitigation is an estimate of the effectiveness of mitigation under NEPA only. The level of effect as defined by §106 may not be similarly reduced. Although adverse effects under §106 may be mitigated, the effect remains adverse.

Consultation with the New Mexico SHPO was conducted at the initiation of scoping for this EA. Upon completion, this EA will be sent to the SHPO for review and comment in partial completion of § 106 compliance for implementation of the new fire management plan for Bandelier National Monument. A MOA will also be executed between Bandelier National Monument and the New Mexico SHPO detailing §106 consultation conditions for project specific activities and specific mitigation requirements to protect cultural resources under this Fire Management Plan. Consultation with concerned Pueblo Indian groups has also been initiated and will be continued to help ensure no adverse impacts occur to ethnographic resources from the proposed action.

ARCHEOLOGICAL RESOURCES

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. For purposes of analyzing impacts to archeological resources either listed in or eligible to be listed in the National Register, the thresholds of change for intensity of an impact are defined below:

Type of Impact

Adverse: A change in the physical attributes of an archeological site that affects the information contained in that site. The change can be irreparable and of permanent duration. Adverse impacts to archeological resources can result from manual or mechanical fuels treatment, direct heating during fire, fire response and suppression, post- fire ecological processes, and emergency rehabilitation.

Beneficial: A change in the physical attributes of an archeological site that affects the information contained in that site. The change is beneficial, for example, burning duff and forest litter exposes mineral soil not visible during inventories of unburned areas, allowing for greater accuracy in documenting site constituents and boundaries; and burning within a natural fire regime reduces the threat of high-intensity fire and the need for suppression activities.

Duration of Impact

Short- term: Due to the non- renewable nature of unknown prehistoric, Ancestral Pueblo or Euroamerican archeological artifacts, short- term impacts could not occur.

Long- term: Impacts that represent permanent or irreparable changes in unknown prehistoric, Ancestral Pueblo or Euroamerican archeological artifacts.

Intensity of Impact

Negligible: Impact is at the lowest levels of detection – barely measurable with no perceptible consequences, either adverse or beneficial, to archeological resources. For purposes of §106, the determination of effect would be no adverse effect

Minor: Adverse impact – disturbance of a site(s) results in little, if any, loss of significance or integrity and the National Register eligibility of the site(s) is unaffected. For purposes of §106, the determination of effect would be no adverse effect.

Beneficial impact – maintenance and preservation of a site(s). For purposes of §106, the determination of effect would be no adverse effect.

Moderate: Adverse impact – disturbance of a site(s) does not diminish the significance or integrity of the site(s) to the extent that its National Register eligibility is jeopardized. For purposes of §106, the determination of effect would be adverse effect.

Beneficial impact – stabilization of a site(s). For purposes of §106, the determination of effect would be no adverse effect.

Major: Adverse impact – disturbance of a site(s) diminishes the significance and integrity of the site(s) to the extent that it is no longer eligible to be listed in the National Register. For purposes of §106, the determination of effect would be adverse effect.

Beneficial impact – active intervention to preserve a site(s). For purposes of §106, the determination of effect would be no adverse effect.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the List of Classified Structures (LCS). Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the Area of Potential Effect (APE). Furthermore, the Monument would seek comments from all potentially interested Pueblos, pursuant to National Register Bulletin 38, in order to identify potential Traditional Cultural Properties (TCPs) located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail below under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with

SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

Approximately 68% of the Monument has been surveyed for archeological sites, with approximately 5% remaining to be surveyed. Twenty- seven percent of the Monument is not surveyable due to steep slopes (>30 degrees). All cultural resource mitigation measures described in Chapter 2 would be implemented under Alternative 1. Archeological sites within fire management units will treated through: evaluation of removal of all dead trees from structural elements; evaluation of removal of all 3- inch diameter and smaller trees (cactus and other non- tree vegetation will remain); retention of larger (> 3 in. diameter) juniper trees growing in structures unless determined to be detrimental to integrity or stability of structure; and removal of large (> 5 in. diameter) conifers (other than juniper trees) growing in structures. All dead, woody material (> 3 in diameter) will be hand- carried off structural elements, lighter slash may remain.

Thinning Activities

Manual and mechanical thinning activities can adversely affect cultural resources in several ways. For example, while the process of raking and scraping pine needle duff and leaf litter does not involve soil excavation, site types such as unknown prehistoric, Ancestral Pueblo or Euroamerican refuse scatters may suffer artifact disturbance and displacement from this activity. The integrity of the location of surface artifacts often contributes significantly to a site's scientific interpretive value, because patterns in past behavior may be discerned from this type of spatial data (Sullivan 1998). Hence, this type of activity may be considered an adverse effect on archeological site types that contain surface refuse scatters.

Several classes of wooden archeological features in the Monument can be directly affected by thinning. Foremost among these are aspen dendroglyphs and historic telephone line insulator trees. The process of manual thinning often involves felling standing live or dead trees with chainsaws and then cutting the logs into portable sections. This action could adversely affect these resources by destroying the trees.

Another result of thinning is the creation of abundant slash piles containing cut logs, limbs, and duff. Slash piles are commonly burned to reduce fuel accumulations or they are left for ignition during a prescribed fire. These piles, which are frequently composed of green, uncured wood, represent dense accumulations of fuel. Accordingly, burning these slash piles produces concentrated fires of high heat and long duration. The possible impacts of these types of burn situations on cultural resources are discussed in the next section on fire effects.

Mitigation measures, including pre- incident planning to identify and protect known archeological resources sites within project areas, would help to mitigate these adverse effects. An archeologist, cultural resource specialist, or resource management staff member would be present on site during thinning operations to identify structural elements, historic aspen dendroglyphs, and insulator

trees, and to supervise directional tree felling and placement of slash to avoid damage to archeological sites. As stated above, archeological sites within fire management units will treated through: evaluation of removal of all dead trees from structural elements; evaluation of removal of all 3- inch diameter and smaller trees (cactus and other non- tree vegetation will remain); retention of larger (> 3 in. diameter) juniper trees growing in structures unless determined to be detrimental to integrity or stability of structure; and removal of large (> 5 in. diameter) ponderosa pine growing in structures. All dead, woody material (> 3 in diameter) will be hand- carried off structural elements, lighter slash may remain. Thus, adverse effects to archeological resources from manual and mechanical thinning are anticipated to be long- term and negligible to minor. No short- term effects would occur due to the non- renewable nature of archeological resources.

The positive uses and beneficial effects of manual and mechanical thinning should also be emphasized. Thinning around archeological sites and masonry structures can be an appropriate and effective method to reduce fuel loads on or around sensitive archeological resources. Under Alternative 1, these beneficial effects are anticipated to be minor to moderate in the long- term.

Prescribed Fire and WFURB

The effects of prescribed and wildland fire on cultural resources have been recognized in many studies over the past 25 years. Most of these studies have focused on the surface and subsurface effects of wildland fire (e.g., Ruscavage- Barz 1999, Traylor et al. 1990), with relatively few focusing on prescribed fire effects (Sayler et al. 1989). The lack of studies on prescribed fire effects is mitigated by the fact that prescribed fires produce effects that are similar to or less severe than those caused by wildland fires. Because the potential effects from a fire are more closely related to the kinds of fuels present than the cause of ignition, it is possible to predict the effects of prescribed fires as readily as wildland fires. The advantage of prescribed fires is that they are managed, so their anticipated adverse effects can be mitigated through a treatment plan conducted prior to ignition.

The effects of heat and combustion on archeological materials and sites differ with respect to the exposure or burial depth of artifacts or features and the intensity of the fire (which is related to the type and amount of fuels present). In general, subsurface artifacts, deposits, and features are less affected by fire than surficial materials, particularly if the cultural material is buried more than 10- 15 centimeters below the surface. Root burn- outs, where the combustion is carried below the ground surface by smoldering fires in the root systems of trees and shrubs, are the primary exception (Ruscavage- Barz 1999).

With regard to intensity, surface fires in areas of naturally high or volatile fuel loads will be more intense (burn hotter and longer) than light- fuel fires in areas experiencing a natural fire frequency. Further, in cases where prescribed burns are carried out in conjunction with manual or mechanical thinning, slash piles can create an artificially high fuel load that exceeds even natural accumulations, leading to fires of higher temperature and longer duration than would otherwise occur during the prescribed burning of naturally accumulated fuels. These types of natural and unnaturally high fuel loads pose the most serious threat to archeological resources.

Heating and combustion have varying effects on archeological Ancestral Pueblo and Euroamerican ceramics depending upon the original firing temperature and atmosphere of the vessel, and the temperature and duration of the surface burn, which is in part determined by the fuel load and fuel types present. Ancestral Pueblo archeological ceramic firing temperatures range from very low (ca. 500°C) to very high (ca. 1200°C), while most Euroamerican ceramics are fired at high kiln temperatures. If a fire's surface temperatures do not exceed the original firing temperature of the ceramic, no structural change to the ceramic will occur. In light fuels, the surface temperature may

never exceed 500°C. However, in heavier fuels (e.g., 100- hour and 1000- hour fuels) and heavy duff, temperatures may easily surpass 500°C even in controlled burn situations

These elevated temperatures may refire the ceramics, causing bloating and changes in hardness, porosity, color, and thickness (Shepard 1980[1956]). Non- structural changes to ceramic pastes, paints, and pigments, and other alterations to Ancestral Pueblo and Euroamerican ceramic surfaces (e.g., sooting, spalling, crazing, and cracking) can also occur which may alter the diagnostic attributes necessary for typological, technological, or functional analysis (Traylor et al, 1990). These impacts to ceramic artifact assemblages may constitute an adverse effect.

As with ceramics, the effects of heating and combustion on unknown prehistoric and Ancestral Pueblo lithic artifacts vary according to rock or mineral type and the temperature and duration of the fire. In general, fine- grained materials such as obsidian and high- quality chert or chalcedony show changes in their properties at lower temperatures. Coarse- grained materials such as lower-quality chert and chalcedony, and certain metamorphic and igneous rocks, are altered only at higher temperatures.

Experimental studies have shown that changes in color, luster, tractability, and translucence of chert and flint are affected by heating to temperatures as low as 200°C (Ahler 1983, Mandeville 1973). Heating to temperatures higher than 300°C can cause crazing and cracking, decreased tensile strength, and increased brittleness of chert and flint (Ahler 1983, Mandeville 1973). Under extreme heat (greater than 600°C), chert and flint can become brittle and crumbly. Color changes and crazing can inhibit raw material identification of siliceous material. Changes to an artifact's color and luster from post- depositional fires can also destroy evidence of cultural heat treatment of lithic material and the presence or absence of this trait is a significant interpretive characteristic. The effects of heat alteration due to post- depositional surface fires can easily be confused with heat alteration by aboriginal stone workers.

Heat spalling or "potlidding" can also have serious effects on stone artifacts. Potlidding can affect any crypto- or micro- crystalline material (particularly chert and flint), and can damage the surface of artifacts to the extent that formal analysis of attributes is not possible. This is particularly problematic in typological analysis of projectile points and other temporally or functionally diagnostic formal tools. The primary cause of potlidding or spalling of lithic materials is a rapid change in temperature, rather than the intensity of heating per se. Lithic artifacts on the surface of a site over which a fire burns are likely to experience a rapid increase in temperature (Mandeville 1973), and are likely to spall, altering the exterior form of the tool. If the alteration is extreme, an artifact may be essentially destroyed and its information potential lost.

Obsidian artifacts can suffer the same types of heat alteration as chert and flint, but can also suffer additional adverse effects such as vesiculation, formation of residue, and alteration of hydration bands used in obsidian hydration dating. The degree to which this occurs depends upon the maximum temperature reached, duration of heating, and chemical composition of the obsidian (Deal and McLemore, 2002; Solomon, 2002; Steffen, 2002). The formation of residue and vesicles (the process of vesiculation) in obsidian results from the rapid heat- induced expansion of volatiles trapped in the volcanic glass (Trembour, 1990). The formation of residue may inhibit in- field visual determination of the obsidian's source, and vesiculation can damage an artifact to the point that formal analysis and attribute recording is not possible. The hydration bands on obsidian artifacts become significantly altered at temperatures of approximately 200- 300°C for more than two hours, and are destroyed at about 500°C, thus making the artifact unusable for obsidian

hydration dating (Deal and McLemore, 2002, Solomon, 2002, Trembour, 1990). This may constitute an adverse effect by destroying the information potential of the artifact. The temperature range for thermal alteration of these lithic material types (200°C to 1000°C) is well within the range of temperatures reached during surface burning under high- fuel load conditions. These alterations may constitute an adverse effect, particularly at temperatures higher than 300°C for more than two hours duration.

Fire effects on metal artifacts also vary with material type and fire intensity and duration. Lead artifacts have a low melting temperature(ca. 327°C), and are likely to be altered by temperatures reached in moderate intensity fires (Haecker n.d., Sayler et al. 1989). Lead is a common component in the solder of historic food and beverage cans. Copper and steel artifacts have higher melting temperatures (1082°C and 1427°C, respectively) and are therefore less subject to alteration in surface fires. Some degree of patination, smoke glazing, and carbon impregnation, as well as changes in malleability, ductility, and tensile strength, may occur in all metal types (Haecker n.d., Sayler et al. 1989). As with lithic and ceramic artifacts, any fire- related alteration of metal artifact integrity or obliteration of diagnostic attributes constitutes a loss of information potential. This threat is greatest to metals with low melting temperatures such as lead or lead alloys (such as soldered cans). Steel cans and other containers, which are one of the most common metal artifact types, have thin walls and high surface areas relative to their mass. These types of items, many of which have already suffered decades of weathering from natural forces such as oxidation and trampling, are subject to accelerated deterioration after fires.

Glass artifacts are highly vulnerable to heat alteration and to impregnation by carbonaceous deposits from combustion of adjacent organic materials. The degree of alteration depends on the composition of the glass and the intensity and duration of the fire. Glass made of silica that contains a flux agent with a low melting temperature (e.g., lead) will be altered at relatively low temperatures. Some crazing, spalling, cracking, sooting, melting, and shattering of glass is possible during most fires (Traylor et al. 1990). Melting and shattering of glass artifacts results in a loss of information potential due to the destruction of diagnostic attributes such as vessel form, maker's marks, manufacturing seam locations, and finish style.

Prescribed and WFURB fires have the potential to adversely affect historic properties containing stone masonry. Heating effects on stone masonry vary from negligible to major depending on the intensity and duration of the fire. A study of fire effects to archeological resources following the 1977 La Mesa Fire in Bandelier reports that the tuff building stone of which most of the structural sites are composed suffered spalling, cracking, and in some instances, a dramatic increase in the rock's friability (Traylor et al. 1990). The severity of the effects increased with increased fire intensity. On more lightly burned sites, the stones suffered discoloration, but little structural damage. Heat alteration of the structural integrity of the building stone of masonry structures may constitute an adverse effect because the stones lose their original shape and the stability of masonry courses is diminished. These effects significantly reduce the integrity of the site. Lower intensity firethat causes discoloration appears to have happened repeatedly in the past (Buenger, 2003, Traylor et al., 1990), and would not adversely affect the resources eligibility to the NRHP.

Similar to tuff masonry, archeological features carved into the tuff such as cavates, petroglyph and pictograph panels can be adversely affected by heat and smoke. Heat effects on cavates, petroglyphs and pictographs are similar to those on tuff building stone. The potential adverse effects would include spalling, cracking, and disintegration of the rock face into which the cavate or rock art was carved. These effects could result in the loss of integrity or total destruction of the historic property, which would constitute an adverse effect. Discoloration of surfaces through

oxidation or sooting would result in a loss of integrity, but one that would not lead to a change in the resource's eligibility to the NRHP. This would constitute no adverse effect. Pictographs, which are composed of mineral pigment applied to a rock face, however, could suffer greater loss of integrity through oxidation of the pigment to a different color.

The potential adverse effects described above would be mitigated through fuel reduction treatments on archeological sites detailed under "Actions Common to All Alternatives" and through implementation of pre- incident planning to identify and protect known archeological resource sites, and other cultural resource mitigations described above and in Chapter 2. In the case of a WFURB event, an analysis of the risk of adverse effects to archeological resources in the fire area would be conducted by a staff archeologist and the fire may be suppressed if adverse effects to archeological resources were identified. Impacts from prescribed fire and WFURB activities on ceramic, lithic, metal, stone, and glass archeological artifacts as well as stone masonry, cavates, and petroglyph and pictograph panels are anticipated to be adverse, long- term, and minor. Beneficial impacts from these activities are anticipated to be long- term and minor to moderate due to the reduction of hazardous fuels on or near archeological sites.

Wooden artifacts and features, being flammable objects, are exceptionally vulnerable to the adverse effects of fire. Wooden artifacts are present at some Euroamerican archeological sites as wooden corral and cabin timbers, wooden crates, scattered lumber, and wooden fence posts. The historic telephone lines that cross the Monument also consist of several hundred standing or downed trees that were used to string the wire through the forest. Historic aspen dendroglyphs themselves constitute a flammable cultural resource. The potential adverse effects of prescribed and WFURB fire can be mitigated by keeping fire away from the objects by means of a hand- line dug around the flammable resource and removing hazard fuels from the site and its perimeter. The hand- line would be monitored by an archeologist, and situated away from subsurface deposits. Loss of information potential would be mitigated through the detailed documented of flammable wooden resources. In special cases where appropriate, wood samples, and rare or museum- quality flammable cultural materials may be collected. These mitigations and those treatments described in Chapter 2 would reduce the fuel load on sites without removing the culturally modified trees if present, and would mitigate the potential for ignition and combustion of wooden or other flammable cultural resources by keeping fire away from these resources. Therefore, prescribed fire and WFURB activities are
anticipated to have no effect on flammable cultural resources because fire will be kept away from these resources.

Fire Suppression
Fire suppression activities and rehabilitation can adversely affect archeological resources. Establishment of a cold line around the perimeter of a fire unit involves mop- up activities such as excavating burning roots and stumps and additional thinning to reduce the amount of available fuel. If the cold line perimeter crosses through archeological sites, excavation within site boundaries will cause an adverse effect to surface and subsurface materials through ground disturbance. Similarly, thinning will adversely affect above- ground resources such as trees with dendroglyphs or telephone line insulators.

Slurry and other fire retardant chemicals used in suppression efforts have the potential to adversely affect archeological resources. Retardant gels may strip surface finishes, damage sandstone and masonry, and act as a desiccant. Slurries may be staining due to the iron oxide content, may contain corrosive metals, may cause efflorescence and water entrapment, and may cause pitting and spalling over the long- term. In order to minimize these potential adverse effects under Alternative

1, the use of slurries and other fire retardant chemicals would only be allowed in an emergency initial attack response in a wildland fire situation; all other applications must be approved by the Superintendent. When possible, archeological resources or culturally sensitive areas would be identified and avoided during use of any slurry or other fire retardant chemical in an emergency initial attack.

Rehabilitation of burn areas and handlines can also have potentially adverse effects on archeological resources. Rehabilitation of handlines or mop- up excavations may involve backfilling excavated holes and depressions, and rehabilitation of burned areas may involve building water bars on slopes or other soil- moving activities. These actions would have adverse effects if soil for backfill is removed from within site boundaries, or if artifact- bearing soil from within a site is transported to other portions of the site or to a different site.

Additionally, if handlines are constructed through the boundaries of a site, either by accident during pre- ignition preparation or through necessity (in the case of a wildland fire, when suppression activities take precedence), adverse effects will occur. In these cases, the handline should be carefully rehabilitated to minimize further damage to the site through additional soil disturbance or subsequent erosion.

Seeding of burned areas is occasionally an aspect of rehabilitation. This action has the potential to positively affect cultural resources by reducing damage from increased sheet wash and gully erosion that can occur in denuded areas. Conversely, if non- native species are seeded in the vicinity of properties that are significant for their feeling, setting, or association, the introduction of new visual elements (e.g., non- native plants) to their viewshed may constitute an adverse effect. In order to promote the beneficial effects from re- seeding, only native, weed- free seed mixtures would be used in cases of re- seeding rehabilitation efforts.

Under Alternative 1, suppression activities would be monitored by an archeologist, cultural resource specialist, or resource management staff member to protect or avoid cultural resources. Crews would be educated on identification of archeological resources and would be instructed to avoid or minimize walking over structural elements. An archeologist, cultural resource specialist, or resource management staff member would aid in positioning crews, holding lines, spike camps, helispots, drop zones, and other fire suppression related activities to avoid or minimize impacts in culturally sensitive areas. Fire suppression activities are anticipated to have adverse, long- term, minor effects on cultural resources based on pre- incident planning efforts described above and mitigations employed during suppression activities.

Cumulative Impacts
Under Alternative 1, other federal or non- federal past, present, and future foreseeable actions that could affect archeological resources include the possible implementation of ecological restoration activities within pinyon- juniper woodlands. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This restoration project would likely have beneficial, minor to moderate, long- term effects on archeological resources, especially when combined with fire management activities in Alternative 1 designed to reduce heavy fuel loading and restore more ecologically sustainable vegetative conditions.

Conclusion
Implementation of Alternative 1, which maintains the current fire management plan, may result in adverse, long- term, negligible to minor impacts to archeological resources from manual and

mechanical thinning. Prescribed fire, WFURB, and fire suppression activities are anticipated to have an adverse long- term, minor effect on archeological resources. There would be no effect to flammable wooden artifacts or features. Beneficial effects for all activities are expected to be long-term and minor to moderate. Cumulative impacts are anticipated to be beneficial, minor to moderate, and long- term. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the LCS. Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the APE. Furthermore, the Monument would seek comments from all potentially interested Pueblo Indian groups, pursuant to National Register Bulletin 38, in order to identify potential TCPs located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail below under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

Approximately 68% of the Monument has been surveyed for archeological sites, with approximately 5% remaining to be surveyed. Twenty- seven percent of the Monument is not surveyable due to steep slopes. All cultural resource mitigation measures described in Chapter 2 would be implemented under Alternative 2. Archeological sites within fire management units will be treated through: evaluation of removal of all dead trees from structural elements; evaluation of removal of all 3- inch diameter and smaller trees (cactus and other non- tree vegetation will remain); retention of larger (> 3 in. diameter) juniper trees growing in structures unless determined to be detrimental to integrity or stability of structure; and removal of large (> 5 in. diameter) ponderosa pine growing in structures. All dead, woody material (> 3 in diameter) will be hand-carried off structural elements, lighter slash may remain.

Thinning Activities
Impacts to archeological resources from manual and mechanical thinning under Alternative 2 would be similar to those under Alternative 1. However, under Alternative 2, manual and mechanical thinning would not be allowed in non- WUI, non- wilderness areas (approximately 5,500 acres) except with Superintendent approval. Impacts to archeological resources from manual and mechanical thinning may be slightly reduced under this alternative due to the small reduction in acres where thinning is allowed. However, overall impacts to archeological resources under this alternative would not change significantly from those described under Alternative 1, adverse, long-term, and negligible to minor.

Prescribed Fire, WFURB, and Fire Suppression
Adverse and beneficial impacts from fire suppression, prescribed fire and WFURB would be similar to those under Alternative 1, adverse, long- term, and minor. Beneficial effects from these activities would be long- term and minor to moderate.

Cumulative Impacts
Cumulative impacts would be similar to Alternative 1, long- term, minor to moderate, and beneficial.

Conclusion
Implementation of Alternative 2 may result impacts similar to those detailed in Alternative 1, adverse, long- term, and negligible to minor impacts to archeological resources from manual and mechanical thinning and adverse long- term, minor effect from prescribed fire, WFURB, and fire suppression activities. Beneficial effects for all activities are expected to be minor to moderate and long- term. Cumulative impacts are anticipated to be long- term, minor to moderate, and beneficial. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

ETHNOGRAPHIC RESOURCES

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. For purposes of analyzing potential impacts to ethnographic resources, the thresholds of change for the intensity of an impact are defined below.

Type of Impact

Adverse: A change in the attributes of an ethnographic resource that is unfavorable and can be of permanent duration. Adverse impacts to ethnographic resources can result from manual or mechanical fuels treatment, direct heating during fire, fire response and suppression, post- fire ecological processes, and emergency rehabilitation. For example, traditionally- used plants can be damaged or destroyed if they are exposed to fire at the wrong point in their life cycle. Wooden features can be destroyed if not protected from burning.

Beneficial: A change in the attributes of an ethnographic resource that is favorable and beneficial, for example, fire was used extensively by American Indians in managing and maintaining some plants for traditional use—continued burning is necessary to maintain the health, vigor, culturally- desirable characteristics, and extent of many traditionally- used plants.

Duration of Impact

Short- term: Causes a temporary change in important vegetation or temporarily restrict access to an important resource, yet do not disrupt the cultural traditions associated with that resource.

Long- term: A change in culturally important vegetation or a cultural feature for a noticeable period. Long- term changes would disrupt cultural traditions associated with the affected resource, but the disruption would not alter traditional activities to the extent that the important cultural traditions associated with the resource are lost.

Permanent: Impacts to ethnographic resources would involve irreversible changes in important resources such that the ongoing cultural traditions associated with those resources are lost.

Intensity of Impact

Negligible: Impact(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be no adverse effect.

Minor: Adverse - impact(s) would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and

beliefs. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be no adverse effect.

Beneficial - would allow access to and/or accommodate a group's traditional practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be no adverse effect.

Moderate: Adverse - impact(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be adverse effect.

Beneficial - would facilitate traditional access and/or accommodate a group's practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be no adverse effect.

Major: Adverse - impact(s) would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. The determination of effect on Traditional Cultural Properties (ethnographic resources eligible to be listed in the National Register) for §106 would be adverse effect.

Beneficial - would encourage traditional access and/or accommodate a group's practices or beliefs. The determination of effect on Traditional Cultural Properties for §106 would be no adverse effect.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

As described in Chapter 2 under "Features Common to All Alternatives", Bandelier National Monument would conduct twice annual consultations regarding fire management activities with the Consultation Committee, which is comprised of representatives of the following six pueblos: Santa Clara, Santo Domingo, San Ildefonso, San Felipe, Zuni, and Cochiti Pueblos. At these meetings, the Monument would present treatment prescription plans, specific treatment maps, and detailed archeological site maps for the plans. The pueblo groups would be able to express their concerns about sensitive cultural or ethnographic resources during these meetings. Bandelier would also facilitate and participate in site visits with interested pueblos as necessary.

Fire management activities including manual and mechanical thinning, prescribed fire, WFURB, and fire suppression have the potential to adversely affect ethnographic resources. The intensity and duration of these impacts would depend upon the nature and significance of the resources as well as the extent of disturbance. These effects would be potentially adverse, short- to long- term, and negligible to minor. Beneficial impacts may result from reduction in hazardous fuel loading and the restoration of a natural fire regime, and would be long- term and minor to moderate.

In addition to twice annual consultation meetings, mitigation measures related to protection of ethnographic resources would be implemented where necessary and appropriate. These mitigation measures may include identification and avoidance of TCPs or other sensitive ethnographic resources, avoidance of thinning activities that may damage traditionally used plants, pre-treatment of TCPs or archeological sites to reduce hazardous fuel loads, and placement of archeologist or cultural resource staff on- site for any fire management activity to direct placement of crews, holding lines, spike camps, helispots, drop zones, and other fire management related activities to avoid or minimize impacts in ethnologically sensitive areas.

Cumulative Impacts
Under Alternative 1, other federal or non- federal past, present, and future foreseeable actions that could affect ethnographic resources include the possible implementation of ecological restoration activities within pinyon- juniper woodlands. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This restoration project would likely have beneficial, long- term, minor to moderate effects on ethnographic resources, especially when combined with fire management activities in Alternative 1 designed to reduce heavy fuel loading and restore more ecologically sustainable vegetative conditions.

Conclusion
Under Alternative 1, which maintains the existing fire management plan, manual and mechanical thinning, prescribed fire, WFURB, and fire suppression activities may have adverse, short- term to long- term, negligible to minor impacts and beneficial, long- term, minor to moderate impacts depending upon the nature and significance of the resources as well as the extent of disturbance. Cumulative impacts are anticipated to be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non- wilderness areas, except in suppression and with Superintendent approval.

As described under Alternative 1, Bandelier National Monument would meet with the Consultation Committee twice annually regarding planned fire management activities. Mitigations listed in Chapter 2 under "Mitigation Measures Common to All Alternatives" would be implemented as necessary and appropriate.

Impacts from manual and mechanical thinning, prescribed fire, WFURB, and fire suppression would be similar to those described under Alternative 1, adverse, short- term and long- term, negligible to minor and beneficial, long- term, minor to moderate.

Cumulative Impacts

Cumulative impacts would be similar to those described under Alternative 1, beneficial, long- term, and minor to moderate.

Conclusion

Impacts under Alternative 2 would be similar to those described under Alternative 1, adverse, short- term to long- term, negligible to minor impacts and beneficial, long- term, minor to moderate impacts, depending upon the nature and significance of the resources as well as the extent of disturbance. Cumulative impacts are anticipated to be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

CULTURAL LANDSCAPE RESOURCES

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. For purposes of analyzing potential impacts to cultural landscape resources, the thresholds of change for the intensity of an impact are defined below.

Type of Impact

Adverse: Physical changes to significant characteristics of a resource or its setting, such as removal or burning of historically important vegetation or burning of historic structures.

Beneficial: Restoration of a natural setting or reduction in heavy fuels adjacent to structures—measures that reduce risk of loss through burning.

Duration of Impact

Short- term: Activities such as temporary removal of vegetation or other contributing resources, road closures, or prescribed burns, where the impacts are noticeable for a period up to five years.

Long- term: Reversible changes, lasting from five to twenty years, in a significant characteristic of a historic structure or landscape.

Permanent: Irreversible changes such as complete removal or burning of important vegetation or structures.

Intensity of Impact

Negligible: Impact(s) is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for §106 would be no adverse effect.

Minor: Adverse - perceptible and measurable; remain localized and confined to a single contributing element of a larger National Register district. The determination of effect for §106 would be no adverse effect.

Beneficial - preservation of landscape patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Moderate: Adverse - sufficient to cause a change in a significant characteristic of an individually significant historic structure; or would generally involve a single or small group of contributing elements in a larger National Register district. The determination of effect for §106 would be adverse effect.

Beneficial - rehabilitation of a landscape or its patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Major: Adverse - Substantial and highly noticeable changes in significant characteristics of an individually significant historic structure; or would involve a large group of contributing elements in a National Register district. The determination of effect for §106 would be adverse effect.

Beneficial - restoration of a landscape or its patterns and features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. The determination of effect for §106 would be no adverse effect.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the List of Classified Structures (LCS). Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the Area of Potential Effect (APE). Furthermore, the Monument would seek comments from all potentially interested Pueblos, pursuant to National Register Bulletin 38, in order to identify potential Traditional Cultural Properties (TCPs) located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail below under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

Thinning Activities

Manual or mechanical thinning would have the potential to adversely impact cultural landscape resources, mainly through inappropriate vegetation removal in cultural landscape or historic site settings. For example, aspen dendroglyphs may be adversely impacted from thinning activities. The process of manual thinning often involves felling standing live or dead trees with chainsaws and then cutting the logs into portable sections. This action would adversely affect dendroglyphs by destroying the trees. The intensity of other impacts to cultural landscape resources would depend on the nature and significance of the resource, as well as the extent of disturbance. Potentially moderate, adverse, and long- term impacts would be avoided by prescribing a target condition for these areas that would protect and enhance the cultural landscape resource. Pre-incident planning, including identification and avoidance of aspen dendroglyphs and other mitigations described in Chapter 2 under "Mitigation Measures Common to All Alternatives" would be implemented under this alternative. Manual and mechanical thinning activities would likely result in adverse, long- term, and negligible to minor impacts to cultural landscape resources.

Prescribed Fire and WFURB

Prescribed fire and WFURB have the potential to adversely affect cultural landscape resources. In the case of WFURB, in areas where heavy fuels have accumulated, it is unlikely wildland fire could be managed at a level necessary to avoid damage to cultural landscape resources unless mitigating measures are implemented either before or early in the WFURB event. In these areas, WFURB would have direct and indirect adverse impacts to these resources. The intensity and duration of these impacts would depend on the nature and significance of the resources, as well as the intensity of burning and the post- burn landscape condition but are anticipated to be at most, adverse, long-term and minor. Fire would also contribute to maintaining cultural landscapes, and impacts would be mitigated to the extent possible. For any WFURB event, an analysis of the risk of adverse effects to archeological resources in the fire area would be conducted by a staff archeologist and the fire may be suppressed if adverse effects to archeological resources were identified.

In areas where fuel loads are lower or areas that have been previously burned, it would be likely that WFURB could be managed to avoid adverse impacts to cultural landscape resources. Maintaining a natural fire regime would likely result in beneficial, long- term, minor to moderate impacts to cultural landscape resources by reducing the potential for high- intensity fires.

For prescribed fires, the potential for adverse impacts to cultural landscape resources would be less than with catastrophic wildfire or WFURB. However, in areas where fuels have accumulated it might not be possible to manage fire to avoid damage to cultural landscape resources, unless mitigations were implemented prior to burning. Prescribed fire may have direct and indirect adverse impacts to resources. The intensity and duration of these impacts would depend on the nature and significance of the resources as well as the intensity of burning, but would be potentially negligible to adverse, long- term, and minor. These impacts would be mitigated as much as possible using pre- incident planning and other mitigations described in Chapter 2 under "Mitigation Measures Common to All Alternatives." Beneficial, long- term, minor to moderate impacts from

prescribed fire would likely result from maintenance of a natural fire regime and reduction in potential of high- intensity fires.

Fire Suppression
Fire suppression activities would have some potential to adversely affect cultural landscape resources. Slurry and other fire retardant chemicals used in suppression efforts may strip surface finishes, damage standstone and masonry, and act as a desiccant. Slurries may be staining due to the iron oxide content, may contain corrosive metals, may cause efflorescence and water entrapment, and may cause pitting and spalling over the long- term. Under Alternative 1, the use of slurries and other fire retardant chemicals would only be allowed in an emergency initial attack response in a wildland fire situation; all other applications must be approved by the Superintendent. When possible, culturally sensitive areas would be identified and avoided during use of any slurry or other fire retardant chemical in an emergency initial attack.

Rehabilitation activities, such as seeding, after fire suppression may positively affect cultural landscape resources by reducing damage from increased sheet wash and gully erosion that can occur in denuded areas. Conversely, if non- native species are seeded in the vicinity of properties that are significant for their feeling, setting, or association, the introduction of new visual elements (e.g., non- native plants) to their viewshed could constitute an adverse effect. As part of the mitigations proposed in Chapter 2, only native, weed- free seed mixtures would be used in cases of re- seeding rehabilitation efforts.

Under Alternative 1, suppression activities would be monitored by an archeologist, cultural resource specialist, or resource management staff member to protect or avoid cultural resources. Crews would be educated on identification of cultural resources and would be instructed to avoid or minimize activities within cultural landscape components. Aspen dendroglyphs and other important cultural landscape features would be identified and avoided. An archeologist, cultural resource specialist, or resource management staff member would aid in positioning crews, holding lines, spike camps, helispots, drop zones, and other fire suppression related activities to avoid or minimize impacts in culturally sensitive areas. Fire suppression activities are anticipated to have adverse, long- term, negligible to minor effects on cultural landscape resources based on pre-incident planning efforts described above and mitigations employed during suppression activities.

Cumulative Impacts
Under Alternative 1, other federal or non- federal past, present and future foreseeable actions that could affect archeological resources include the possible implementation of ecological restoration activities within pinyon- juniper woodlands. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This restoration project would likely have beneficial, long- term, and minor to moderate effects on cultural landscape resources, especially when combined with fire management activities in Alternative 1 designed to reduce heavy fuel loading and restore more ecologically sustainable vegetative conditions.

Conclusion
Implementation of Alternative 1, which maintains the current fire management plan, may result in adverse, long- term, negligible to minor impacts to cultural landscape resources from manual and mechanical thinning. Prescribed fire and WFURB activities are anticipated to have an adverse, long- term, minor effect on cultural landscape resources. Fire suppression activities are anticipated to have adverse, long- term, negligible to minor impacts. Beneficial effects for all activities are expected to be long- term and minor to moderate. Cumulative impacts are anticipated to be

beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impact apparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the LCS. Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the APE. Furthermore, the Monument would seek comments from all potentially interested Pueblo Indian groups, pursuant to National Register Bulletin 38, in order to identify potential TCPs located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail above under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with

SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

All cultural resources mitigations described in Chapter 2 under "Mitigation Measures Common to All Alternatives." would be implemented as needed under Alternative 2.

Thinning Activities
Impacts to cultural landscape resources from manual and mechanical thinning under Alternative 2 would be similar to those under Alternative 1. However, under Alternative 2, manual and mechanical thinning would not be allowed in non- WUI, non- wilderness areas (approximately 5,500 acres) except with Superintendent approval. Impacts to cultural landscape resources from manual and mechanical thinning may be slightly reduced under this alternative due to the small reduction in acres where thinning is allowed without Superintendent approval. However, overall impacts to cultural landscape resources under this alternative would not change significantly from those described under Alternative 1, adverse, long- term, and negligible to minor.

Prescribed Fire, WFURB, and Fire Suppression
Adverse and beneficial impacts from prescribed fire and WFURB would be similar to those under Alternative 1, adverse, long- term, and minor and beneficial, long- term, minor to moderate. Fire suppression activities would have adverse, long- term, and negligible to minor effects on cultural landscape resources.

Cumulative Impacts
Cumulative impacts would be similar to Alternative 1, beneficial, long- term, and minor to moderate.

Conclusion
Implementation of Alternative 2 may result impacts similar to those detailed in Alternative 1, adverse, long- term and negligible to minor impacts to cultural landscape resources from manual and mechanical thinning; adverse, long- term, and minor for prescribed fire and WFURB activities; and adverse, long- term, negligible to minor effects for fire suppression activities. Beneficial impacts from all activities are expected to be long- term and minor to moderate. Cumulative impacts would be similar to those described for Alternative 1, beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other

relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

HISTORIC RESOURCES

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here.

Type of Impact

Adverse: A change in the attributes of a historic resource that is unfavorable and can be of permanent duration.

Beneficial: A change in the attributes of a historic resource that is favorable.

Duration of Impact

Both beneficial and adverse effects can be short- term, long- term, or permanent.

Intensity of Impact

Negligible: Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for §106 would be no adverse effect.

Minor: Adverse - alteration of a feature(s) would not diminish the overall integrity of the resource. The determination of effect for §106 would be no adverse effect.

Beneficial - stabilization/ preservation of features in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. The determination of effect for §106 would be no adverse effect.

Moderate: Adverse - alteration of a feature(s) that would diminish the overall integrity of the resource and cause a sufficient change in a significant characteristic of the feature (s). The determination of effect for §106 would be adverse effect.

Beneficial - rehabilitation of a structure in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. The determination of effect for §106 would be no adverse effect.

Major: Adverse - alteration of a feature(s) that would diminish the overall integrity of the resource and cause a substantial and highly noticeable change in a significant characteristic of the feature (s). The determination of effect for §106 would be adverse effect.

Beneficial - restoration of a structure in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. The determination of effect for §106 would be no adverse effect.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the LCS. Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the APE. Furthermore, the Monument would seek comments from all potentially interested Pueblos, pursuant to National Register Bulletin 38, in order to identify potential TCPs located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail below under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the

Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

The Bandelier Civilian Conservation Corps (CCC) Historic District is the only historic resource in the Monument that is listed on the National Register of Historic Places. Under Alternative 1, the CCC District is located in the fire suppression zone and WUI at Monument headquarters in Frijoles Canyon (Figure 2.4). While the WUI is not emphasized under this alternative, it does allow for fire suppression, prescribed fire, and manual and mechanical thinning in areas where forest structure has been altered or where cultural resources and developed areas may be adversely affected from fire. No WFURB would be allowed in the suppression zone. All natural ignitions within the boundaries of the suppression zone would be declared wildfires and would be suppressed. Prescribed fire would be utilized for the purposes of hazard fuel reduction and natural and cultural resource management. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives."

Thinning Activities

Manual and mechanical thinning activities have the potential to adversely affect historic resources. Removing historic vegetation within the CCC District or damaging historic structures through tree felling could potentially constitute an adverse effect. Mitigations described in Chapter 2 under "Actions Common to All Alternatives" would be implemented as appropriate to minimize these potential adverse effects. Under Alternative 1, thinning activities would be monitored by an archeologist, cultural resource specialist, or resource management staff member to protect or avoid historic resources. Crews would be educated on identification of historic resources and would be instructed to avoid or minimize activities within the historic district. An archeologist, cultural resource specialist, or resource management staff member would aid in tree felling operations and positioning of crews. Historic vegetation and other important historic landscape features would be identified and avoided. Other mitigations as described in Chapter 2 would be implemented as appropriate. Adverse impacts on historic resources from manual and mechanical thinning are expected to be short- term and negligible. Beneficial impacts on historic resources from removing hazardous vegetation and reducing the risk of catastrophic wildlife would be long- term and minor to moderate.

Prescribed Fire and WFURB

Prescribed fires have the potential to adversely affect historic properties containing stone masonry. Heating effects on stone masonry vary from negligible to major depending on the intensity and duration of the fire. As stated above, a study of fire effects to archeological resources following the 1977 La Mesa Fire in Bandelier reported that the tuff building stone, of which most of the structural sites are composed, suffered spalling, cracking, and in some instances, a dramatic increase in the rock's friability (Traylor et al. 1990). The severity of the effects increased with increased fire intensity. On more lightly burned sites, the stones suffered discoloration, but little structural damage. Heat alteration of the structural integrity of the building stone of masonry structures would constitute an adverse effect because the stones lose their original shape and the stability of masonry courses is diminished. These effects significantly reduce the integrity of the site. Lower intensity fire that causes discoloration appears to have happened repeatedly in the past (Buenger 2003, Traylor et al. 1990), and would not affect the resources eligibility to the NRHP.

Fire Suppression
Fire suppression activities also have the potential to adversely affect historic resources. Slurry and other fire retardant chemicals may strip surface finishes, damage standstone and masonry, and act as a desiccant. Slurries may be staining due to the iron oxide content, may contain corrosive metals, may cause efflorescence and water entrapment, and may cause pitting and spalling over the long-term. Under Alternative 1, the use of slurries and other fire retardant chemicals would only be allowed in an emergency initial attack response in a wildland fire situation; all other applications must be approved by the Superintendent. When possible, archeological resources or cultural sensitive areas would be identified and avoided during use of any slurry or other fire retardant chemical in an emergency initial attack.

Rehabilitation activities, such as seeding, after fire suppression may positively affect cultural resources by reducing damage from increased sheet wash and gully erosion that can occur in denuded areas. Conversely, if non- native species are seeded in the vicinity of properties that are significant for their feeling, setting, or association, the introduction of new visual elements (e.g., non- native plants) to their viewshed could constitute an adverse effect. As part of the mitigations proposed in Chapter 2, only native, weed- free seed mixtures would be used in cases of re- seeding rehabilitation efforts.

Under Alternative 1, prescribed fire and fire suppression activities would be monitored by an archeologist, cultural resource specialist, or resource management staff member to protect or avoid historic resources. Crews would be educated on identification of historic resources and would be instructed to avoid or minimize, to the extent possible, suppression activities that may cause an adverse effect to historic resources. An archeologist, cultural resource specialist, or resource management staff member would aid in positioning crews, holding lines, spike camps, helispots, drop zones, and other fire suppression related activities to avoid or minimize impacts on historic resources. Fire suppression activities are anticipated to have adverse, long- term, minor effects on historic resources based on pre- incident planning efforts described above and mitigations employed during prescribed fire and fire suppression activities.

There would be no WFURB allowed in the suppression zone. All natural ignitions within the boundaries of the suppression zone would be declared wildfires and would be suppressed. Therefore, there would be no effects from WFURB on historic resources.

Cumulative Impacts
Under Alternative 1, other federal or non- federal past, present, and future foreseeable actions that could affect historic resources include the possible implementation of ecological restoration activities within pinyon- juniper woodlands. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. This restoration project would likely have beneficial, minor to moderate, long- term effects on historic landscape resources, especially when combined with fire management activities in Alternative 1 designed to reduce heavy fuel loading, suppress unwanted wildland fires, and restore more ecologically sustainable vegetative conditions in the Monument.

Conclusion
Implementation of Alternative 1, which maintains the existing fire management plan, would result in adverse, short- term, and negligible impacts to historic resources from manual or mechanical thinning. Adverse impacts from prescribed fire and fire suppression would be long- term and minor. There would be no effects from WFURB, as it is not allowed in the fire suppression zone

under this alternative. Beneficial impacts from thinning activities, prescribed fire, and fire suppression would be long- term and minor to moderate. Cumulative impacts are anticipated to be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity of beneficial impacts is greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

All fire management activities under Alternative 2 must follow the guidelines established in an FMP MOA for §106 consultation on a project –specific basis. This MOA would be signed by the State of New Mexico Historic Preservation Officer and the Superintendent of Bandelier National Monument. Bandelier's §106 consultation requirements outlined in this MOA would include development of project- specific fire management treatment plans that may include prescribed burning, manual thinning, or other treatments analyzed in this EA. The treatment plans would define the proposed actions, and if the project includes prescribed fire, the anticipated level of fire intensity and resulting severity of impacts on cultural resources. Project areas or burn units that contain unsurveyed tracts of land on slopes less than 30 degrees would be subjected to intensive surveys. Project areas that have been previously inventoried would be assessed for the presence of historic properties through examination of the BAND cultural resource base maps, the Monument's archeological site database, and the LCS. Monument archeologists would visit each known site within a proposed treatment unit and assess the potential for adverse effects to each site from the proposed project. In this site- specific assessment, the archeologist would determine whether any sites would require special protective measures to mitigate the effects of the project. The mitigation measures are outlined in Chapter 2. WFURB fire activities differ from the above with respect to §106 compliance only in that these activities would not be presented at the annual Fire Management Committee meeting. The Monument, in consultation with the SHPO, would follow the procedures described in 36 CFR 800.4(c) to evaluate the historical significance for all historic properties within the APE. Furthermore, the Monument would seek comments from all potentially interested Pueblo Indian groups, pursuant to National Register Bulletin 38, in order to identify potential TCPs located within the APE, and would then apply National Register criteria and evaluate the historical significance of those properties identified. Copies of all recommendations of eligibility for the National Register would be submitted to the SHPO for concurrence.

For every burn plan, the Monument would document the results of the field inventory, document consultation efforts with Pueblos regarding properties of traditional religious and cultural value (described in further detail above under Ethnographic Resources), and identify any proposed measures to avoid any potential adverse effects to historic properties. As part of consultation with SHPO and other consulting parties, the Monument would submit the report for review and comment. The report would present a determination of no historic properties affected pursuant to 36 CFR 800.4(d)1), no adverse effect, pursuant to 36 CFR 800.5(b) for the project(s); or historic properties may be adversely affected pursuant to 36 CFR 800.5(a)1).

If avoidance of adverse effects is not possible, the Monument would work to resolve adverse effects with the SHPO and other appropriate parties in accordance with 36 CFR 800.6. If the Monument determines that adverse effects cannot be avoided or resolved, or if SHPO objects to a finding of no adverse effect, the Monument may rescind some prescribed fire or mechanical

treatment activities in the analysis area and consult further in accordance with 36 CFR 800.6 to resolve the adverse effects.

All cultural resources mitigations described in Chapter 2 under "Mitigation Measures Common to All Alternatives" would be implemented as needed under Alternative 2.

Thinning Activities
Adverse impacts from manual and mechanical thinning under Alternative 2 would be similar to those described under Alternative 1, short- term and negligible. Beneficial impacts would be long-term and minor to moderate

Prescribed Fire, WFURB, and Fire Suppression
Prescribed fire and fire suppression impacts would be similar to those described under Alternative 1, adverse, long- term, and minor. Beneficial impacts would be long- term and minor to moderate. There would be no effects from WFURB under Alternative 2.

Cumulative Impacts
Cumulative impacts to historic resources under Alternative 2 would be similar to those under Alternative 1, beneficial, long- term, and minor to moderate.

Conclusion
For manual and mechanical thinning, implementation of Alternative 2 would have similar impacts to those described under Alternative 1, adverse, short- term and negligible. For prescribed fire and fire suppression, implementation of Alternative 2 would have impacts similar to those under Alternative 1, adverse, long- term, and minor. Beneficial impacts for manual and mechanical thinning, prescribed fire, and fire suppression would be long- term and minor to moderate. WFURB would have no effect on historic resources. Cumulative impacts would be beneficial, long- term, and minor to moderate. When comparing the adverse and beneficial impacts, the intensity of beneficial impacts is greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

SOCIAL ENVIRONMENT

PUBLIC HEALTH AND SAFETY

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The area of analysis for this topic includes the Monument plus the local communities of Los Alamos, White Rock, Santa Fe, and other nearby communities in the Jemez Mountains. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Degrades or otherwise negatively affects public health and safety.

Beneficial: Improves on characteristics of the existing environment, as it relates to public health and safety.

Duration of Impact

Short- term: Impacts would last for the duration of the fire or treatment action.

Long- term: Impacts would last longer than the duration of the fire or treatment action.

Intensity of Impact

Negligible: Public health and safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on the public health or safety

Minor: The effect would be detectable, but would not have an appreciable effect on public health and safety. If mitigation were needed, it would likely be successful.

Moderate: The effects would be readily apparent and would result in noticeable effects to public health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful.

Major: The effects would be readily apparent and would result in substantial, noticeable effects to public health and safety on a regional scale. Extensive mitigation measures would be needed, and their success would be unknown.

Impact Analysis Common to All Alternatives:

The fire management strategies of suppression, prescribed fire, and WFURB are allowed under each alternative. These fire actions inherently involve some risk to the health, safety, and property of the general public, Monument visitors, Monument staff, and firefighters. Threats from wildland fire peak in the late spring and early summer pre- monsoon months and persist through high fire danger seasons. Impacts are immediate when there is a fire. Direct impacts can include injuries and possible loss of life and property. Indirect impacts can result from episodic smoke exposure.

Under all alternatives, the highest priority for fire management is the protection of life, health, and property from fire. Each alternative proposed in this EA requires the institution of a comprehensive set of procedures that will be followed to ensure public health and safety (see Chapter 2: The Alternatives, Features Common to All Alternatives, Public and Firefighter Safety). Additionally, the following mitigation measures to be carried out under each alternative would minimize smoke impacts: 1) All prescribed burning and pile burning will comply with State of New Mexico air quality guidelines and smoke management regulations, 2) A site- specific prescribed burn plan will be prepared for each project and will include all of the required elements related to air quality in RM- 18, 3) Unhealthy or hazardous accumulations of smoke will trigger an aggressive suppression action that will continue until the air quality attains acceptable levels, 4) Cooperation and coordination with other land management agencies will be initiated to minimize cumulative smoke impacts. (See also the Air Quality analysis in this chapter).

Although fire poses a threat to public health and safety, its careful implementation and management is also an effective tool for reducing hazardous fuels and the risk of catastrophic fire in and surrounding the Monument. In addition, because prescribed fire and WFURB are implemented and managed under more controlled conditions, with pre- planning for the protection of health and safety, as well as appropriate notification and permitting prior to the implementation of fire, the potential for adverse impacts to public health and safety are less than with unplanned fire events. In summary, prescribed fire and WFURB can produce adverse, short-term, minor to moderate impacts as well as beneficial, long- term, minor to moderate impacts to public health and safety.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

See "Impact Analysis Common to All Alternatives" above for a description of impacts from prescribed fire and WFURB.

The moderate use of manual and mechanical thinning under Alternative 1 would result in localized, adverse, short- term, negligible to minor impacts to public health and safety due to dust emissions, smoke from pile burning, and the use of chainsaws and other motorized equipment.

Cumulative Impacts

Other federal or non- federal past, present, and future foreseeable actions that could affect public health and safety include the possible implementation of restoration activities within the pinyon-juniper vegetation community. This project could entail using chainsaws and hand tools to cut down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. The use of chainsaws may contribute slightly to dust emissions, but this would cause no substantial off- site adverse health and safety concerns to nearby residents. Therefore, this project, along with the activities associated with Alternative 1, would likely result in adverse, short- term, minor to moderate impacts to public health and safety.

Conclusion
The impacts on public health and safety due to unplanned fire events, fire suppression efforts, prescribed burning, WFURB, and manual and mechanical thinning under Alternative 1 would be adverse, short- term, and range from negligible to moderate, as well as beneficial, long- term, and minor to moderate. Cumulative impacts would be adverse, short- term, and minor to moderate. While the intensity of adverse and beneficial impacts are similar, adverse impacts would occur in the short- term and beneficial impacts would be long- term.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis
Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval. Other features under this alternative that would potentially affect public health and safety are an emphasis on activities in the WUI.

See “Impact Analysis Common to All Alternatives” above for a description of impacts from prescribed fire and WFURB.

The very limited use of manual and mechanical thinning under Alternative 2 would result in few, if any, off- site adverse impacts to public health and safety. In the unlikely event that adverse impacts did occur due to dust emissions, smoke from pile burning, and the use of chainsaws and other motorized equipment, they would be short- term and negligible.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions that could affect public health and safety include the possible implementation of restoration activities within the pinyon-juniper vegetation community. This project could entail using chainsaws and hand tools to remove live juniper trees to promote the growth of herbaceous vegetation. The use of chainsaws may

contribute slightly to dust emissions, but this would cause no substantial off- site adverse health and safety concerns to nearby residents. Therefore, this project, along with the activities associated with Alternative 1, would likely result in adverse, short- term, negligible to minor impacts to public health and safety.

Conclusion
The impacts on public health and safety due to unplanned fire events, fire suppression efforts, prescribed burning, WFURB, and manual and mechanical thinning under Alternative 2 would be adverse, short- term, and negligible to minor, as well as beneficial, long- term, and minor to moderate. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

VISITOR USE AND EXPERIENCE

Methodology
The assessment of impacts uses the general methodology described above and the resource specific information provided here. The area of analysis for this topic includes all Monument lands. Topics considered are noise, smoke, odors, visibility, traffic congestion, visitor access to areas and facilities, and viewsheds. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions.

Type of Impact

Adverse: Reduces visitor participation, quality of visitor experience.

Beneficial: Enhances visitor participation, quality of visitor experience.

Duration of Impact

Short- term: Temporary in nature, during the period when a fire management activity would take place.

Long- term: Lasts longer than the period when a fire management activity would take place.

Intensity of Impact

Negligible: Changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be small. The visitor would be aware of the effects, but the effects would be slight and would not disrupt the visitor experience such that the Monument's values and facilities could not be enjoyed.

Moderate: Changes in visitor use and/or experience would be readily apparent and the visitor would be aware of the effects, which would degrade or limit the visitor's enjoyment of the Monument's values and/or facilities.

Major: Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the effects, which would result in the visitor not being able to experience or enjoy Monument values or facilities. Mitigation would not be possible or very successful.

Impact Analysis Common to All Alternatives

Prescribed fire, WFURB, and Fire Suppression Activities
Prescribed fire, WFURB, and fire suppression activities could affect visitor use and experience through noise, smoke, odors, reduced visibility, traffic congestion, visitor use restrictions, and disruption of viewsheds. Noise created by fire crews would be temporary and localized to the immediate area on prescribed fires and WFURB. Noise during fire suppression activities may be greater due to the potential use of chainsaws and helicopters. Smoke generated by fire would cause short- term odor and reduced visibility, leading to temporary road closures and possible traffic congestion on portions of highway 4. There could be temporary restrictions on visitor use, depending on the location, intensity, and extent of fire activities. These restrictions or closures could apply to trails, campgrounds, and visitor use facilities. The landscape or viewshed may be charred or burned after a fire, causing short- term adverse impacts, but in the long- term would have the beneficial impact of restoring and maintaining open vistas and natural forest structure. Overall, the impacts from prescribed fire, WFURB, and fire suppression activities would be adverse, short and long- term, and negligible to minor and beneficial, long- term, and minor.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

Prescribed Fire, WFURB, and fire suppression
Impacts from prescribed fire, WFURB, and fire suppression activities would be adverse, short and long- term, and negligible to minor and beneficial, long- term, and minor. See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile burning
Pile burning under Alternative 1 could result in noise disturbance from fire crews, smoke and odors from burning, and reduced visibility, although these impacts would be short- term and negligible. Except in the immediate area of where piles would be burned, visitor restrictions, road closures, and traffic congestion are unlikely and potential impacts would likely be adverse, short- term, and negligible to minor.

Thinning Activities
Manual thinning under Alternative 1 would be conducted in the WUI and non- WUI, non-wilderness areas of the Monument. There would be potential for noise impacts from chainsaws and work crews, but these impacts would be short- term and minor near the thinning areas. Chainsaw use could also cause temporary odor impacts. Except in the immediate thinning area, it is unlikely that restrictions on visitor use or closures would occur. Viewsheds and landscapes could be adversely affected due to the presence of cut trees and stumps. These impacts would be long-term and minor.

Mechanical thinning would be conducted in WUI and non- WUI, non- wilderness areas. No dozers would be allowed in the Monument. There would be short- term noise impacts from machinery, vehicles, and crews. Odors from exhaust would cause short- term negligible impacts. Except in the immediate thinning area, it is unlikely that restrictions on visitor use or closures would occur. Viewsheds and landscapes would be adversely affected due to the presence of machinery, cut trees, stumps, and possible tracks in the soil. Overall, impacts from mechanical thinning under Alternative 1 would be adverse, short- term and negligible due to noise and odors from machinery exhaust, and adverse, long- term, and minor due to cut trees and stumps.

Cumulative Impacts
Other federal or non- federal past, present, and future foreseeable actions to be considered are the possible implementation of restoration activities within Bandelier's pinyon- juniper vegetation community. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. There are no fire management projects planned in this area, so fire suppression would be the only activity to consider in regard to cumulative impacts. The restoration project and fire suppression activities included under Alternative 1 would result in adverse, short- term, and negligible to minor cumulative impacts on visitor use and experience.

Conclusion
Impacts to visitor use and experience from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 1 would likely be adverse, short and long- term, and range from negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impactapparatus only, is not allowed in non- WUI/ non- wilderness areas, except in suppression and with Superintendent approval.

Prescribed Fire, WFURB, and fire suppression

Impacts from prescribed fire, WFURB, and fire suppression activities would be adverse, short and long- term, and negligible to minor and beneficial, long- term, and minor. See "Impact Analysis Common to All Alternatives" above for a discussion of the impacts of prescribed fire, WFURB, and fire suppression as proposed under this alternative.

Pile burning

Impacts to visitor use and experience from pile burning under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and negligible to minor.

Thinning Activities

Impacts to visitor use and experience from manual thinning under Alternative 2 would be the same as under Alternative 1: adverse long term, and minor. Impacts to visitor use and experience from mechanical thinning under Alternative 2 would be the same as under Alternative 1: adverse, short- term and negligible due to noise and odors from machinery exhaust, and adverse, long- term, and minor due to cut trees and stumps.

Cumulative Impacts

Cumulative impacts to visitor experience under Alternative 2 would be the same as under Alternative 1: adverse, short- term, and negligible to minor.

Conclusion

Impacts to visitor use and experience from fire suppression, prescribed fire, WFURB, manual thinning, and mechanical thinning as proposed under Alternative 2 would likely be adverse, short and long- term, and range from negligible to minor. There would also be beneficial, long- term, minor to moderate impacts. Cumulative impacts would be adverse, short- term, and negligible to minor. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts are greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

THIS PAGE INTENTIONALLY LEFT BLANK

SPECIAL DESIGNATIONS: WILDERNESS

Methodology

The assessment of impacts uses the general methodology described above and the resource specific information provided here. The area of analysis for this topic includes all Bandelier designated wilderness. The intensity of effects and impact duration are described in the analysis below using the following criteria and definitions:

Type of Impact

Adverse: Degrades wilderness values or interferes with the public's use and enjoyment of wilderness.

Beneficial: Improves or maintains wilderness values or enhances the public's use and enjoyment of wilderness.

Duration of Impact

Short- term: Occurs in the period concurrent with the implementation of actions or leaves evidence of human activity that lasts no more than five years after the action.

Long- term: Continues after completion of the actions and can be expected to persist for longer than five years.

Intensity of Impact

Negligible: Impacts would have no discernable effect on wilderness resources. Natural conditions and processes would prevail. There would be no permanent visual improvements or human habitation. The wilderness area would be affected primarily by the forces of nature. There would be outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Minor: Impacts would be detectable within limited areas of the wilderness. Natural conditions and processes would predominate. There would be no permanent visual improvements or human habitation. The wilderness area would generally appear to have been affected primarily by forces of nature. While there may be short- term actions in the wilderness, over the long- term, outstanding opportunities for solitude or a primitive and unconfined type of recreation would prevail.

Moderate: Impacts would be readily apparent within limited areas of the wilderness. There would be no permanent visual improvements or human habitation. The wilderness area would appear to have been affected primarily by forces of nature, however, it would be evident that humans have affected the area. Outstanding opportunities for solitude or a primitive and unconfined type of recreation would be restricted within limited areas of the wilderness.

Major: Impacts would substantially alter the wilderness resource throughout the designated wilderness area. Natural conditions would have been substantially altered by

humans. Improvements made by humans, while not permanent, would be long-term and become part of the landscape. Outstanding opportunities for solitude or a primitive and unconfined type of recreation would be restricted within the designated wilderness.

Impacts of Alternative 1: No Action (Maintain Existing Plan)

Impact Analysis

Alternative 1, the current fire management program, includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI and in non- WUI/ non- wilderness areas, although no dozers are allowed in the Monument.

Over 70% (approximately 23,267 acres) of Bandelier is designated wilderness. Of this, approximately 2,792 acres are located in the fire suppression unit and approximately 20,475 acres are in the WFURB unit. Figure 2.1 shows both units within Bandelier's wilderness boundary. Within designated wilderness, there are Project Areas totaling approximately 10,936 acres. Within these areas, fire suppression (following Minimum Impact Suppression Tactics), prescribed fire, and manual thinning with hand tools are allowed. Fuels are removed by prescribed broadcast burning and pile burning. Fire and fire effects monitoring and mitigations are conducted as detailed under "Mitigations Common to All Alternatives." Under Alternative 1, as a general rule, motorized and/or mechanized equipment will not be allowed in wilderness areas. Specifically, mechanical thinning is not allowed in designated wilderness unless during wildland fire suppression using the Minimum Requirements Decision Guide (Carhart Center, 2002) as described below, and with Superintendent approval.

The Wilderness Act of 1964 (16 USC §1131- 1136), Section 4(c) states that…"Except as specifically provided for in this Act and, **except as necessary to meet minimum requirements for the administration of the area** for the purpose of this Act, ...there shall be no use of motor vehicles, motorized equipment …, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area." Based on this language, NPS Management Policies 2001 (NPS 2001c) requires the NPS to take into account wilderness characteristics and values when evaluating the environmental impacts of a project or administrative activities that are proposed in wilderness. Further, all management decisions affecting wilderness must be consistent with the Minimum Requirements Decision Guide (Carhart Center, 2002) to document the process used to determine whether administrative activities affecting wilderness resources or visitor experience in the wilderness are necessary, and how to minimize the impacts. Under NPS Management Policies (NPS 2001a, Section 6.3.5), administrative use of motorized equipment or mechanical transport will be authorized only:

- If determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness character and values; or

- In emergency situations (search and rescue) involving the health or safety of persons actually within the area. Such management activities will be conducted in accordance with all applicable regulations, policies, and guidelines, including the minimum [requirements decision guide] protocols as practicable.

Management Policies (NPS 2001c) also states that "if a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character and/or have localized, short- term adverse impacts will be acceptable."

Thinning Activities
As described above, only manual thinning with hand tools would be allowed in wilderness areas. The use of chainsaws for manual thinning would only be allowed after using the Minimum Requirements Decision Guide (Carhart Center 2002), and with Superintendent approval. Mechanical thinning would not be allowed in wilderness areas, except in suppression of a wildland fire, using the Minimum Requirements Decision Guide, and with Superintendent approval.

The use of hand tools for thinning would have adverse, short- term, and negligible impacts due to the presence of cut trees and stumps. Stumps would be flush cut to the ground as much as possible, and slash and debris would be scattered to further reduce adverse visual effects. Impacts would have no discernable effect on wilderness resources and natural conditions would prevail. There would continue be outstanding opportunities for solitude or a primitive and unconfined type of recreation.

There would be beneficial, long- term, minor effects from thinning using hand tools in the wilderness. This would be primarily due to the reduction in hazardous fuels in the area. Reducing hazardous fuels would serve to preserve wilderness character and values through minimizing the threat of catastrophic wildfires which could severely damage vegetation communities in the wilderness.

Prescribed Fire and WFURB
All prescribed fires and WFURB activities would be subject to using the Minimum Requirements Decision Guide (Carhart Center, 2002). Prescribed fire activities in wilderness are likely to have only adverse, short- term, negligible to minor impacts, which would not be readily discernable from effects due to forces of nature. Minimum impact suppression tactics for prescribed fire would be used in wilderness. However, impacts from site preparation may be visible to visitors within the immediate area. Stumps cut flush with the ground and other saw cuts may be visible. This would diminish the wilderness character of the area, through the evidence of human activities. In order to minimize adverse visual effects, stumps would be flush cut to the ground as much as possible, and slash and debris would be scattered to further reduce adverse visual effects.

Prescribed fire would have beneficial, long- term, moderate impacts on wilderness in Bandelier, primarily due to hazard fuel reduction and restoration of natural fire processes within vegetation communities.

The WFURB zone contains 20,475 acres of designated wilderness. Impacts of WFURB activities on wilderness values may be seen as adverse to some visitors, but to most wilderness visitors the effects would be seen as acceptable and natural. Fire in plant communities that are within their natural range of variability would rarely result in extreme events with major effects. The typical effects of fire may include blackened bark, opening of the understory, clearing the forest floor, and the scorching of some trees—resulting in scattered kill and opening of the canopy. Helicopters may be used for reconnaissance, monitoring, and movement of people and supplies. Chainsaws may be used during holding actions; these may adversely affect wilderness character on in the short- term. It is likely that wilderness users would see the natural effects of fire as beneficial, long-term, and moderate on a landscape scale, and the effects of equipment use on the wilderness experience as adverse, short- term, and minor to moderate.

Fire Suppression

Fire suppression activities would have impacts similar to those described above under prescribed fire: adverse, short- term, and negligible to minor. Helicopters may be used for reconnaissance, monitoring, and movement of people and supplies. Chainsaws may be used during holding actions; these may adversely affect wilderness character on in the short- term. In addition, impacts from site preparation may be visible to visitors within the immediate area. Stumps cut flush with the ground and other saw cuts may be visible. This would diminish the wilderness character of the area, through the evidence of human activities. In order to minimize adverse visual effects, stumps would be flush cut to the ground as much as possible, and slash and debris would be scattered to further reduce adverse visual effects. Mechanical and motorized tools (including helicopters) would only be used after evaluating the impacts using the Minimum Requirements Decision Guide (Carhart Center, 2002) and with Superintendent approval.

Cumulative Impacts

Under Alternative 1, other federal or non- federal past, present, and future foreseeable actions that could affect wilderness resources include the possible implementation of ecological restoration activities within pinyon- juniper woodlands. This project could entail cutting down selected live and dead pinyon and juniper trees. The trees would be lopped and scattered over the ground to reduce erosion and promote the growth of herbaceous vegetation. There may be some adverse, short- term, negligible to minor cumulative impacts on wilderness values from equipment use in the ecological restoration activities and the FMP, but there would likely be beneficial, long- term, moderate effects on wilderness resources at the landscape scale, especially when combined with fire management activities in Alternative 1 designed to reduce heavy fuel loading and restore more ecologically sustainable vegetative conditions.

Conclusion

Manual thinning using hand tools is expected to have adverse, short- term and negligible impacts on wilderness. Beneficial impacts from manual thinning are expected to be long- term and minor. Prescribed fire and WFURB activities are anticipated to have adverse, short- term, negligible to minor impacts on wilderness resources. Beneficial impacts would be long- term and moderate. Cumulative impacts would likely be adverse, short- term, and negligible to minor as well as beneficial, long- term, and moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts is greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Impacts of Alternative 2: Multiple Strategy Program

Impact Analysis

Alternative 2 includes the fire management actions of suppression, prescribed fire, and WFURB. It also includes the use of manual and mechanical thinning in the WUI. Manual thinning is not allowed in non- WUI/ non- wilderness areas, except with Superintendent approval. Mechanical thinning, accomplished with low soil impact apparatus only, is not allowed in non- WUI/ non-wilderness areas, except in suppression and with Superintendent approval.

Activities in designated wilderness proposed under Alternative 2 are the same as those described under Alternative 1. Manual thinning with hand tools, prescribed fire, and WFURB activities would be conducted in wilderness, but no mechanical thinning would be allowed in designated wilderness except under suppression with Superintendent approval, using the Minimum Requirements Decision Guide (Carhart Center, 2002).

Impacts from manual thinning using hand tools are anticipated to be similar to Alternative 1: adverse, short- term, and negligible and beneficial, long- term, and minor. Impacts from prescribed fire and WFURB are anticipated to be similar to those described above under Alternative 1, adverse, short- term, negligible to minor and beneficial, long- term, and moderate. Impacts from fire suppression would be similar to those described under Alternative 1: adverse, short- term, and negligible to minor.

Cumulative Impacts

Cumulative impacts under Alternative 2 are anticipated to be similar to those described above under Alternative 1: adverse, short- term, and negligible to minor as well as beneficial, long- term, and moderate.

Conclusion

Activities in designated wilderness under Alternative 2 would have impacts similar to those described under Alternative 1. For manual thinning using hand tools, adverse impacts would be short- term and negligible. Beneficial impacts would be long- term and minor. For prescribed fire and WFURB activities, impacts would be adverse, short- term, negligible to minor as well as beneficial, long- term, and moderate. Cumulative impacts are anticipated to be adverse, short-term, and negligible to minor as well as beneficial, long- term, and moderate. When comparing the adverse and beneficial impacts, the intensity and duration of beneficial impacts is greater than the adverse impacts.

Because there would be no major, adverse impacts to a resource or value whose conservation is 1) necessary to fulfill specific purposes identified in the establishing legislation of Bandelier National Monument; 2) key to the natural or cultural integrity of the Monument or to opportunities for enjoyment of the Monument; or 3) identified as a goal in the General Management Plan or other

relevant NPS documents, there would be no impairment of the Monument's resources or values under this alternative.

Chapter 5
CONSULTATION AND COORDINATION

INTRODUCTION

In January 2001, following the fire season of 2000, a Report to the President was prepared and a new Federal Wildland Fire Management Policy was released. The new policy was a revision and update of the December 1995 Final Report of the Federal Wildland Fire Management Policy and Program Review. This document was accepted by the Secretaries of Interior and Agriculture. It endorsed the older policy and strengthened the principles, policies, and recommendations of the 1995 report. A National Fire Plan was also introduced and approved. This national plan directed the NPS to expedite the removal of hazardous fuels from WUI areas to provide for the immediate protection of natural and cultural resources, physical property, and facilities, both federal and private. As a result of the national direction, in 2003 Bandelier decided to initiate a review of their fire management plan.

CONSULTATION AND COORDINATION ACTIVITIES

The process used in consultation and coordination for the Bandelier Fire Management Plan/Environmental Assessment/Assessment of Effect is described below.

In February 2003, Bandelier staff members identified the need for a new fire management plan and created an Interdisciplinary Team that would be responsible for reviewing, updating, and writing the new fire management plan and NEPA document. The team consisted of the following National Park Service and United States Geological Survey staff: Superintendent, Fire Management Officer, Assistant Fire Management Officer, Fire Information Officer, Fire Ecologist, Chief of Resources, Outdoor Recreation Planner, Archeologists, Wildlife Biologist, Vegetation Specialist, United States Geological Survey Senior Research Scientist, Protection Ranger, and Chief of Maintenance. In subsequent meetings with the IDT, new fire management goals and objectives were discussed and created, important impact topics were identified, and alternatives were further considered. Staff members were assigned duties and writing and research assignments were given.

Public scoping is a necessary and important part of the NEPA process (40 CFR 1501.7). Scoping ensures that the public has the opportunity to be involved in identifying issues to be considered in the planning process and allows for input on the development of management alternatives. In March 2003, Bandelier hosted a field trip to the Frijoles Canyon area for cooperators and neighboring agencies from the federal, state, and local levels. Participants included representatives from the Santa Fe National Forest, New Mexico State Forestry, Los Alamos County Fire Department, Los Alamos National Laboratory, and the Nature Conservancy. These partners offered comments on the planning process and priorities for the Fire Management Plan.

On August 6, 2003, a Notice of Intent to prepare an EIS was published in the Federal Register. Bandelier then sent a brochure to individuals, organizations, media, and agency and government offices detailing the proposed fire management alternatives. The scoping brochure invited recipients to identify fire management issues and make recommendations for fire management

alternatives. Bandelier then held three public scoping meetings to encourage public participation. The meetings were held in August 2003 in Albuquerque, Santa Fe, and Los Alamos. Twenty- six people attended the three meetings and 32 comment letters were received during the scoping period.

Comments from the public scoping sessions and internal discussions and meetings resulted in substantial changes to the fire management plan alternatives proposed under the EIS. Based on these changes, The NPS determined that the appropriate NEPA documentation for the update and review of Bandelier's Fire Management Plan was an EA/Assessment of Effect. A cancellation of notice of intent to prepare an EIS for the Fire Management Plan at Bandelier was then published in the Federal Register.

Throughout the spring and summer of 2004, writing and research assignments were undertaken. In September of 2004, the EA was completed. During October of 2004, the EA/Assessment of Effect was circulated for peer review and Intermountain Region review. Comments were incorporated and the document was made available for public review in October. (More information will be included here after the public comment period).

LIST OF PREPARERS AND REVIEWERS

Table 5- 1. List of Preparers and Reviewers

Name and Position*	Responsibility	Education	Years of Experience
Darlene Koontz*, Superintendent	•Review and oversight	•B.S. Forestry	•24 years NPS
Gary Kemp, Fire*, Management Officer	•Review and oversight	•B.S Resource Management	•8 years NPS •6 years FWS
Marla Rodgers*, Assistant Fire Management Officer	• Scoping meetings •Review •Alternatives •Oversight	•B.A. Geography	•18 years NPS
Laura Trader*, Fire Ecologist	•Scoping meetings •Project management •Purpose and Need •Alternatives •Affected Environment •Impact Analysis •Review	•B.S. Environmental Studies and Biology •M.S. Forest Sciences, pending completion of thesis •Certificate Geospatial Sciences	•9 years NPS

Jim Whittington*, Fire Education, Prevention, and Information Specialist	•Consultation and Coordination •Scoping meetings •Review	•B.A. History •M.A. U.S. History	•5 years National Archives and Records Administration •5 years Environmental Protection Agency •3 years U.S. Forest Service •3 years NPS
John Mack*, Chief, Resources Management	•Review and oversight	•B.S. Biology •M.S. Fish and Wildlife Management	•15 years NPS
Jennifer Carpenter*,	• NHPA Section 106 Consultation •ESA Section 7 Consultation and Biological Assessment •Affected Environment •Impact Analysis	•B.S. Ecology •M.S. Applied Ecology and Environmental Resources	•6 years private sector environmental consulting •1 year NPS •1 year state wildlife agency
Brian Jacobs*, Vegetation Specialist	•Impact Analysis	•B.S. Systematic Botany •M.S. Population Genetics	•14 years NPS
Steve Fettig*, Wildlife Biologist	•Impact Analysis	•M.S.	•10+ years NPS
Craig Allen, Senior Research Scientist	•Review	•PHD Ecology	•18 years NPS/USGS/NBS
Kay Beeley*, Cartographic Technician	•GIS maps and figures	•B.S. Environmental Planning and Management	•19 years NPS
Rory Gauthier*, Supervisory Archeologist	•Review	•B.A. Archeology	•20 years NPS
Cynthia Herhahn*, Archeologist	•NHPA Section 106 Consultation •Affected Environment •Impact Analysis •Review	•M.S. Anthropology •PHD Anthropology	•3.5 years NPS
Brian Dominy*, Protection Ranger	•Review	•B.S. Urban Park/Forestry Management	•13 years NPS

Lynne Dominy*, Chief of Interpretation	•Review	•B.S. Park Management	•16 years NPS

* Bandelier National Monument staff.

This EA/Assessment of Effect will be sent to the agencies, tribes, organizations, and individuals listed in Appendix H. It will also be placed at Bandelier's Visitor Center, Bandelier's Fire Management Office, and on the NPS web site.

TABLES, FIGURES, AND APPENDICES

List of Tables

List of Figures

List of Appendices

LITERATURE CITATIONS

Ahler, S.A. 1983. "Heat Treatment of Knife River Flint". Lithic Technology 12(1):1- 8.

Albini, F.A., 1976. Estimating Wildfire Behavior and Effects. USDA For. Serv. Gen. Tech. Rep. INT- 30, 92 p. Intermt. For. And Range Exp. Stn., Ogden, Utah.

Allen, C.D. 1984. "Montane Grasslands in the Landscape of the Jemez Mountains, New Mexico". M.S. Thesis, University of Wisconsin, Madison, 195 pp.

_____. 1989. "Changes in the landscape of the Jemez Mountians, New Mexico". PhD. Dissertation. University of California, Berkeley.

_____, and R. Touchan., and T.W. Swetnam. 1995. "Landscape Scale Fire History Studies Support Fire Management Action at Bandelier". R. Hiebert, G.E. Davis, J. Dennis, J. Jarvis, and E. Johnson, eds. Park Science 15(3). National Park Service, Natural Resources Publication Office.

_____. 2002. "Lots of lightning and plenty of people: An ecological history of fire in the upland Southwest". Chapter 5 (pp. 143- 193) In: T.R. Vale, ed. Fire, Native Peoples, and the Natural Landscape. Island Press, Covelo, CA.

Anderson, H.E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA For. Serv. Gen. Tech. Rep. INT- 122, 22p. Intermt. For. And Range Exp. Stn., Ogden, Utah 84401.

Arthur Carhart National Wilderness Training Center. 2002. Minimum Requirement Decision Guide. Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service. Online: http://www.wilderness.net/index.cfm?fuse=MRDG. Accessed July 14, 2004.

Beaty, M. R. and A. H. Taylor. 2001. "Spatial and temporal variation of fire regimes in a mixed conifer forest landscape, Southern Cascades, California, USA". Journal of Biogeography. 28: 955- 966.

Birnbaum, C.A. 1994. Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes. Preservation Briefs 36, Technical Preservation Services, National Park Service. Online: http://www2.cr.nps.gov/tps/briefs/brief36.htm.

Bond, W. J., B.W. Wilgen. 1996. Fire and Plants. Chapman and Hall Publishing.

Brown, D.E., C.H. Lowe, and C.P. Pase. 1980. A digitized systematic classification for ecosystems with an illustrated summary of the natural vegetation of North America. USDA For. Serv. Gen. Tech. Rep. RM- 73, Ft. Collins, Colo. 93pp.

Buenger, B.A. 2003. "The impact of wildland and prescribed fire on archaeological resources". PhD Dissertation, Department of Anthropology, University of Kansas, Lawrence.

City of Boulder. 1999. Forest Ecosystem Management Plan. Open Space and Mountain Parks Department, City of Boulder, Colorado. Online: http://www3.ci.boulder.co.us/openspace/publications/plans/Forest/forestmain.htm. Accessed May 3, 2004.

Cook, R.R., C.H. Flather, K.R. Wilson. 2000. Faunal characteristics of the Southern Rocky Mountains of New Mexico: Implications for biodiversity analysis and assessment. Gen Tech. Rep. RMRS- GTR- 58. Ft. Collins, CO: U.S. Department of Agribculture, Forest Service, Rocky Mountain Research Station. 55p.

Council on Environmental Quality (CEQ). 1981. Forty most asked questions concerning council on environmental quality's national environmental policy act regulations. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. 40 CFR Parts 1500- 1508, Washington, D.C.

Covington, W.W. and M.M. More. 1992. "Postsettlement changes in natural fire regimes: Implications for restoration of old- growth ponderosa pine forest". In: Old- growth forest in the Southwest and Rocky Mountain regions: proceedings of a workshop, p. 81- 99. USDA For. Serv. Gen. Tech. Rep. RM- 213. 201p

Deal, K. and D. McLemore. 2002. "Effects of Prescribed Fire on Obsidian and Implications for Reconstructing Past Landscape Conditions". In: J.M. Loyd, T.M. Origer, and D.A. Fredrickson, eds. The Effects of Fire and Heat on Obsidian. Cultural Resource Publication, Anthropology- Fire History, U.S. Department of the Interior, Bureau of Land Management. pp. 15- 44.

Delaney , D.K. and T.G. Grubb. 1997. "Effects of helicopter noise on nesting Mexican spotted owls in the Jemez Mountains". Unpublished report. 13 pages plus appendix.

Dodd, N.L. 1988. "Fire management and southwestern raptors". In: R.L. Glinski, B.G.Pendleton, M.B. Moss, [and others], eds. Proceedings of the southwest raptor symposium and workshop; 1986 May 21- 24: Tucson, AZ. NWF Scientific and Technology Series No.11. Washington, D.C.: National Wildlife Federation: 341- 347.

Dull, R.A. 1999. "Paleontological evidence for 19th century grazing- induced vegetation change in the southern Sierra Nevada, California, U.S.A". J. Biogeog. 26: 899- 912.

Graham, R.T., R. Rodriguez, K. Paulin, R. Player, A. Heap, R, Williams. 1999. The northern goshawk in Utah: habitat assessment and management recommendations. Gen Tech. Rep. RMRS- GTR- 22. Odgen, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain, Research Station, 48 pp.

Hamilton, Steve, Diane Larson, Susan Finger, Barry Poulton, Nimish Vyas, and Elwood Hill. Ecological effects of fire retardant chemicals and fire suppressant foams. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdata/fireweb/fireweb.htm (Version 02MAR98).

Haecker, C.M. n.d. "Effects of Fire on Historic Structures". MS Thesis on file, National Park Service, Intermountain Support Office, Santa Fe, New Mexico.

Hardy, CC., Schmidt, K.M., Menakis, J.M., Samson, N.R. 2001. "Spatial data for national fire planning and fuel management". International Journal of Wildland Fire 10:353- 372.

Harrison, Laura S. 1988. "Appendix E: National Historic Landmark Nomination". In: L. Harrison, R, Copeland, and R, Buck, eds. Bandelier National Monument, Historic Structures Report, CCC Buildings. Denver, CO: U.S. Department of the Interior, National Park Service, Denver Service Center. pp. 283- 303.

Hubbard, J.P. 1985. "Bald eagle (Haliaeetus leucocephalus)". New Mex. Dept. Game and Fish, Handbook Spec. End. in New Mexico:BIRD/AC/HA/LE:1- 2.

Johnson, T. 1994. "Peregrine Falcon Habitat Management in Bandelier National Monument, New Mexico". Unpublished Report. U.S. Department of the Interior, National Park Service.

Kimmins, J.P. 1997. Forest Ecology: A Foundation for Sustainable Management. Prentice- Hall, Inc.

Lehman, R.N. and J.W. Allendorf. 1989. "The effects of fire, fire exclusion and fire management on raptor habitats in the western United States". Western Raptor Management Symposium and Workshop: 236- 244.

Lissoway, J. 2004. Electronic message from John Lissoway to Laura Trader, Bandelier National Monument, New Mexico. U.S. Department of the Interior, National Park Service. May 14.

Lyon, L.J., E.D. Tefler, and D.S. Schreiner. 2000a. "Chapter 3: Direct Effects of Fire and Animal Responses". In: J.K. Smith, ed. Wildland Fire in Ecosystems, Effects of Fire on Fauna. Gen. Tech. Rep. RMRS- GTR- 42- vol.1. Ogden, UT: U.S Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83p.

Lyon, L.J., M. H. Huff, E.D. Telfer, D.S. Schreiner, and J.K Smith. 2000b. "Chapter 4: Fire Effects on Animal Populations". In: J.K. Smith, ed. Wildland Fire in Ecosystems, Effects of Fire on Fauna. Gen. Tech. Rep. RMRS- GTR- 42- vol.1. Ogden, UT: U.S Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83p.

Mandeville, M.D. 1973. A Consideration of the Thermal Pretreatment of Chert. Plains Anthropologist. 18:177- 202.

New Mexico Game and Fish Department (NMGFD). 2004a. "Bald Eagle Species Account [040370]". New Mexico Game and Fish Biota Information System of New Mexico. Online: http://fwie.fw.vt.edu/states/nmex_main/species/040370.htm. Accessed July 13, 2004.

_____. 2004b. "Townsend's Big- eared Bat Species Account [050025]". New Mexico Game and Fish Biota Information System of New Mexico (BISON- M). Online: http://fwie.fw.vt.edu/states/nmex_main/species/050025.htm. Accessed July 12, 2004.

_____. 2004c. "Spotted Bat Species Account [050095]". New Mexico Game and Fish Biota Information System of New Mexico (BISON- M). Online: http://fwie.fw.vt.edu/states/nmex_main/species/050095.htm. Accessed July 12, 2004.

_____. 2004d. "Jemez Mountains Salamander Species Account [020060]". New Mexico Game and Fish Biota Information System of New Mexico (BISON- M). Online: http://fwie.fw.vt.edu/states/nmex_main/species/020060.htm. Accessed: July 12, 2004.

New Mexico Natural Heritage Program (NMNHP). 2004. "Species Information for Los Alamos and Sandoval Counties, New Mexico". New Mexico Natural Heritage Program Biological and Conservation Data System. Internet Version, Updated November 7, 2003. Online: http://nmnhp.unm.edu/query_bcd/bcd_county_results.php?output=print. Accessed: March 4, 2004.

National Park Service (NPS). 1995a. Resource Management Plan, Bandelier National Monument. U.S. Department of the Interior, National Park Service. January 1995.

_____. 1995b. Bandelier National Monument Peregrine Falcon Habitat Management Plan. U.S. Department of the Interior. National Park Service.

_____. 1997. Fire Management Plan, Bandelier National Monument. U.S. Department of the Interior, National Park Service. January 1997.

_____. 2000a. Strategic Plan, Bandelier National Monument. U.S. Department of the Interior, National Park Service.

_____. 2001a. NPS Management Policies 2001. U.S. Department of the Interior, National Park Service. NPS D1416, December 2000.

_____.2001b. Fire Monitoring Handbook. U.S. Department of the Interior, National Park Service.

_____.2001c. Director's Order #12 and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision- Making. U.S. Department of the Interior, National Park Service. Washington, D.C.

_____. 2002. "Draft Vegetation Management Plan, Bandelier National Monument, New Mexico". Unpublished Report. U.S Department of the Interior, National Park Service.

_____. 2003. Director's Order #18: Wildland Fire Management. U.S. Department of the Interior, National Park Service. Washington, D.C.

_____. 2004a. "Tsankawi Unit: Cultural Landscapes Inventory". Cultural Landscapes Inventory Database. U.S. Department of the Interior, National Park Service, Intermountain Region, Cultural Landscapes Program. Santa Fe, New Mexico.

_____. 2004b. "Frijoles Canyon: Cultural Landscapes Inventory". Cultural Landscapes Inventory Database. U.S. Department of the Interior, National Park Service, Intermountain Region, Cultural Landscapes Program. Santa Fe, New Mexico.

_____. Unpublished data. Fire Effects Monitoring Program, Bandelier National Monument, New Mexico. U.S. Department of the Interior, National Park Service.

Ortiz, A. 1969. The Tewa World: Space, Time, Being, and Becoming in a Pueblo Society. University of Chicago Press.

Reynolds, R.T., R.T. Russell, M.H. Reiser, and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM- 217, Ft. Collins,

CO: U.S. Department of Agriculture, Forest Service, Rocky Mountian Forest and Range Experiment Station. 90p

Rothermel, R.C., 1972. A Mathematical Model for Fire Spread Predictors in Wildland Fuels. USDA For. Serv. Res. Pap. INT- 115, 40 p. Intermt. For. And Range Exp. Stn., Ogden, Utah.

Ruscavage- Barz, S.M. 1999. "Fire in the Hole: The Effects of Fire on Subsurface Archaeological Materials". Manuscript in prep, on file Bandelier National Monument, New Mexico.

Sayler R.D., R.W. Seabloom, and S.A. Ahler. 1989. "Impacts of Prescribed Burning on Archaeological and Biological Resources of the Knife River Indian Villages NHS". Report submitted for Contract No. PX 1200- 8- 0833, National Park Service and University of North Dakota, Grand Forks.

Schmidt, K.M., Menakis, J.P., Hardy C.C., Hann, W.J., Bunnell, D.L. 2002. Development of course-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep., RMRS- GTR- 87, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Schutter, M. 2003. Presentation given in Ecology of Disturbance at Colorado State University, Colorado.

Shepard, A.O. 1980 [1956]. Ceramics for the Archaeologist. Publication 609. Carnegie Institution, Washington, D.C.

Solomon, M. 2002. "Fire and Glass: Effects of Fire on Obsidian Hydration Bands". In: J.M. Loyd, T.M. Origer, and D.A. Fredrickson, eds. The Effects of Fire and Heat on Obsidian. Cultural Resources Publication, Anthropology- Fire History, U.S. Department of the Interior, Bureau of Land Management. pp. 69- 94.

Squires, J.R. and R.T. Reynolds. 1997. "Northern goshawk (Accipiter gentilis)". In: A. Poole, F. Gill, eds. Birds of North America, No. 298. Philadelphia, PA. The Academy of Natural Sciences; Washington D.C.: The American Ornithologists Union

Steffen, A. 2002. "The Dome Pilot Project: Extreme Obsidian Fire Effects in the Jemez Mountains, New Mexico". In: J.M. Lloyd, T.M. Origer, and D.A. Fredrickson, eds. The Effects of Fire and Heat on Obsidian. Cultural Resources Publication, Anthropology- Fire History, U.S. Department of the Interior, Bureau of Land Management. pp. 159- 202.

Sullivan, A.P. 1998. Surface Archaeology. University of New Mexico, Albuquerque.

Swetnam, T.W., and C.H. Baisan. 1996. "Historical Fire Regime Patterns in the Southwestern United States Since A.D. 1700". Pp. 11- 32 In: C.D. Allen, ed. Fire Effects in Southwestern Forests: Proceedings of the Second La Mesa Fire Symposium. 1994 March 29- 31; Los Alamos, New Mexico. USDA For. Serv. Gen. Tech. Rep. RM- GTR- 286. Fort Collins, Colorado. 216 p.

Touchan, R.T., C. D. Allen, and T.W. Swetnam. 1996. "Fire History and Climatic Patterns in Ponderosa Pine and Mixed- Conifer Forests of the Jemez Mountains, Northern New

Mexico". Pp. 33- 46 In: C.D. Allen, ed. Fire Effects in Southwestern Forests: Proceedings of the Second La Mesa Fire Symposium; 1994 March 29- 31; Los Alamos, New Mexico. RM-GTR- 286. USDA For. Serv. Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

Traylor, D, L. Hubbell, N. Wood, and B. Fielder. 1990. The 1977 La Mesa Fire Study: An investigation of fire and fire suppression impact on cultural resources in Bandelier National Monument. Southwest Cultural Resources Center, Professional Paper No. 28. Cultural Resources Management, Division of Anthropology, National Park Service, Santa Fe.

Trembour, F.N. 1990. "Appendix F: A Hydration Study of Obsidian Artifacts, Burnt vs. Unburnt by the La Mesa Forest Fire". In: D. Traylor, L. Hubbell, N. Wood. and B. Fielder, eds. The 1977 La Mesa Fire Study: An investigation of fire and fire suppression impact on cultural resources in Bandelier National Monument. Southwest Cultural Resources Center, Professional Paper No. 28. pp. 174- 190.

U.S Fish and Wildlife Service (USFWS). 1995a. Recovery Plan for the Mexican Spotted Owl: Vol. I. U.S. Department of the Interior, Fish and Wildlife Service. Albuquerque, NM.

_____.1995b. Letter from Jennifer Fowler- Propst, Field Supervisor, U.S. Fish and Wildlfie Service to Roy Weaver, Superintendent Bandelier National Monument. Consultation # 2- 2- 95- I-532. December 4.

_____. 1998. "Summary Biological Opinion on the Effects of Bandelier National Monument's Fire Management Program on the Mexican Spotted Owl". Consultation No. 2- 22- 95- F- 532. November 12, 1998.

_____. 2004a. Reinitiation of Formal Section 7 Consultation for the Programmatic Fire Management Plan. Memorandum to Superintendent, Bandelier National Monument from U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office. May 27, 2004.

_____. 2004b. Draft Environmental Assessment for Designated of Critical Habitat for the Mexican Spotted Owl. U.S. Department of the Interior, Fish and Wildlife Service. Region 2. Albuquerque, NM.

United States Department of Agriculture. 1998. Fire Fighting Chemicals - Their Similarities and Differences. http://www.fs.fed.us/rm/fire/Fire_Chemicals_Defined.html

United States Department of Agriculture Natural Resource Conservation Service. 2000. Special Project Soil Survey of Bandelier National Monument. Santa Fe Soil Survey Office.

Wright, H.A., A.W. Bailey. 1982. Fire Ecology: United States and Southern Canada. A Wiley- Interscience Publication.

Appendices
To the
Bandelier National Monument
Fire Management Plan
Environmental Assessment/Assessment of Effect

APPENDIX A – GLOSSARY

Aboriginal: Native, indigenous.

Active Crown Fire: When the main surface fire and the fire burning in the crowns are moving together across the fire front.

Adaptive Management: A type of natural resource management that implies making decisions as part of an on- going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Appropriate Management Response: The response to a wildland fire is based on an evaluation of risks to firefighter and public safety, the circumstances under which the fire occurs, including weather and fuel conditions, natural and cultural resource management objectives, protection priorities, and values at risk. The evaluation must also include an analysis of the context of the specific fire within the overall local, geographic area, or national wildland fire situation.

Arthropod: A group of invertebrates which have a segmented body and jointed limbs and an external skeleton (e.g. insects, spiders and crustaceans).

Artifact: An object that was made, used, and/or transported by humans that provides information about human behavior in the past.

Aspect: The direction a slope faces. For example, a hillside facing east has an eastern aspect.

Backcountry: Areas of the monument generally without modern developments, such as roads and utilities.

Backing fire: Fire spreading, or ignited to spread, into (against) the wind or downslope. A fire spreading on level ground in the absence of wind is a backing fire.

Biological Diversity (Biodiversity): The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

Biomass: 1. Wood products that may or may not be used commercially
2. The total weight of all living organisms in a biological community.

Biota: The plant and animal life of a particular region.

Broadcast Burning: Intentional burning within well defined boundaries for reduction of fuel hazard, as a resource management treatment, or both.

Burned Area Rehabilitation: The full range of post- fire activities to rehabilitate and restore fire damaged lands, including protection of public health and safety.

Caldera: A vast depression at the top of a *volcanic cone*, formed when an eruption substantially empties the reservoir of *magma* beneath the cone's summit. Eventually the summit collapses inward, creating a caldera.

Canopy: The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi- storied forest.

Catastrophic Fire: See stand replacing fire.

Carrion: The decaying flesh of a dead animal that is used as food for scavenging animals.

Cavate: A cavity in the canyon wall that is primarily the result of excavation of the rock.

Collaboration: Managers, scientists and citizens working together to plan, implement and monitor land management activities. The intention is to engage people who have information, knowledge, expertise and an interest in the health of natural ecosystems and nearby communities.

Control Burn: See Prescribed Fire or Burn.

Cooperators: Federal, state, and local agencies and Indian tribes that participate in planning and conducting fire management projects and activities.

Critical Habitat: Areas designated for the survival and recovery of state or federally listed threatened or endangered species.

Crypto- crystalline: An adjective applied to materials, particularly rocks and minerals, whose texture is so fine that no distinct particles are visible, even under the microscope.

Cultural Resource: Includes historic properties such as archeological sites, traditional cultural properties, cultural landscapes, historic structures, as well as specific cultural values.

Cultural Landscape: The spatial distribution of cultural activities across a landscape at a given moment in time.

Degradation: Reduction in quality.
1. The process whereby the water quality and chemical, physical or biological integrity of a water body is decreased.
2. Habitat quality can be changed by certain management activities. If the quality is reduced then habitat degradation has occurred.

Dendroglyph: Pictures, symbols, or other artwork pecked, carved or incised on living trees.

Diurnal: Having a daily cycle or occurring everyday.

Diversity: The distribution and abundance of different plants and animals within an area.

Ductility: The ability of a material to be stretched into a new shape without it breaking.

Duff: The partially decomposed organic material of the forest floor that lies beneath the freshly fallen twigs, needles and leaves. The fermentation and humus layers of the forest floor.

Ecosystem: An arrangement of living and non- living things and the forces that move them. Living things include plants and animals. Non- living parts of ecosystems may be rocks and minerals. Weather and wildland fire are two of the forces that act within ecosystems.

Ecosystem Sustainability: The capacity to maintain ecosystem health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.

Edge Effects: Habitat conditions created at or near the more- or- less well- defined boundary between ecosystems, as, for example, between open areas and adjacent forest.

Efflorescence: The accumulation of minerals on an exposed surface often due to moisture migrating through a masonry wall, evaporating, and leaving the dissolved minerals in the moisture on the exposed surface.

Emission: The release or discharge of a substance into the environment; generally refers to the release of gases or particulates into the air.

Endangered Species: Those plant or animal species that are in danger of extinction throughout all or a significant portion of their range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Episodic: Occurring or appearing at usually irregular intervals .

Erosion: The wearing away of land or soil by the action of wind, water, or ice.

Escarpment: A long, more or less continuous cliff or relatively steep slope produced by erosion or by faulting.

Ethnographic Resources: Resources that relate to the aspect of cultural anthropology concerned with the descriptive documentation of living cultures.

Fauna: The animal life of an area.

Fine Fuels: Fuels that ignite readily and are consumed rapidly by fire (e.g., cured grass, fallen leaves, needles, small twigs less than ¼ inch diameter, also referred to as 1- hour fuels).

Fire Frequency: A general term referring to the recurrence of fire in a given area over time.

Fire Hazard: A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree of ignition and of resistance to control. For example, the moisture content of the fuel will influence the ability of the fuel to catch and sustain fire (degree of ignition) and how difficult it will be to control or extinguish the fire (degree of control).

Fire Management Activities: Include fire planning, fire management strategies, tactics, and alternatives, prevention; preparedness, education, and addresses the role of mitigation, post- fire rehabilitation, fuels reduction, and restoration activities in fire management.

Fire Management Plan: A strategic plan that defines a program to manage wildland fires based on an area's approved land management plan. Fire Management Plans must address a full range of fire management activities that support ecosystem sustainability, values to be protected, protection of firefighter and public safety, public health and environmental issues, and must be consistent with resource management objectives and activities of the area.

Fire Management Units: Geographic areas based upon similar values such as desired landscape conditions, strategies to manage fires, post- fire restoration strategies, fuels management strategies and other management values such as wildland urban interface, natural or cultural resources.

Fire Regime: The combination of fire frequency, predictability, intensity, severity, seasonality, and extent that is characteristic of fire in a particular ecosystem.

Fire Return Interval: Describes the average range of years between naturally occurring fire events in different vegetation types. Expressed as the arithmetic average (mean fire return interval) of all fire intervals in a given area over a given time period.

Fire Return Interval Departure: The number of fire return intervals that would have occurred naturally in the absence of fire suppression.

Fire Risk: See wildland fire risk.

Flora: The plant life of an area.

Floristic Elements: Different species present in the flora.

Foraging: The act of searching for food and provisions.

Friability: Excessive breakableness.

Frontcountry: Areas of the monument that include modern developments, such as roads and utilities.

Fuel Hazard: A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.

Fuelbreak: A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread, intensity, and create barriers to fire spread.

Fuel load: The amount of combustible material (dead plants and trees, litter, and duff) that is found in an area.

Fuels: Plants and woody vegetation, both living and dead, that are capable of burning.

Fuels Management: The planned manipulation and/or reduction of living and dead forest fuels for forest management and other land use objectives.

Fuels Treatment: The treatment of fuels that left untreated, would otherwise interfere with effective fire management or control. For example, prescribed fire can reduce the amount of fuels that accumulate on the forest floor.

Germination: The beginning of vegetative growth of a plant from a seed.

Habitat: The area where a plant or animal lives and grows under natural conditions.

Handline: A line cleared of all vegetation and fuels (down to mineral soil) used to help control a fires spread. Width varies depending on fuel type.

Hazard Reduction: In fuels management: the planned treatment or manipulation of naturally growing vegetation or any other flammable material for the purpose of reducing the rate of spread and the output of heat energy from any wildland fire occurring in the treated area.

Hazard Reduction Prescription: These are the specific parameters used to describe the conditions such as specific width, patch size and shape, species composition, diameter distributions, canopy cover, surface fuel mosaic, fire behavior, and location. They are determined at the site- specific project level based on topography, access, vegetation, risk of ignition, and potential fire behavior (this includes weather and wind).

Helispots: Areas cleared of vegetation and dead and down fuels used to land helicopters.

Herbaceous: Referring to a plant that has little or no woody tissue and usually persists only for a single growing season.

Hibernacula: The places in which an animal hibernates or overwinters.

Holding line: A natural or human- made line that is used to limit the spread of a fire. A holding line can either be a line clear of burnable fuels, or a line that is pretreated by water or retardant to be made fire resistant.

Hydrophobicity: Or water repelancy can develop in soils as a result of drying or fire.

Igneous rock: Rock formed by the cooling and hardening of molten materials: granite, basalt, lava.

Infiltration: Flow of water from the land surface into the subsurface.

Initial Attack: The aggressive response to a wildland fire based on values to be protected, benefits of response, and reasonable cost of response.

Interdisciplinary Team: A diverse group of professional resource specialists who analyze the effects of Alternatives on natural and other resources. Through interaction, participants bring different points of view and a broader range of expertise.

Interagency Coordination: Collaboration, communication among cooperating agencies.

Intermittent Stream: A stream that flows only at certain times of the year when it receives water from streams or from some surface, such as melting snow.

Ladder Fuels: Fuels, such as branches, shrubs or an understory layer of trees, which allow a fire to spread from the ground to the canopy.

Landscape: A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts.

Limbing: Removal of large tree limbs to reduce fuel load and the potential for crown fires.

Lithic: Of or pertaining to stone. In archaeology, lithic artifacts include ground and chipped stone tools and the debris resulting from their manufacture.

Long- term Risk: A risk to be experienced within the next 50 to 100 years.

Lopped: Plants or trees having the top or outer parts cut off.

Management Action: Any activity undertaken as part of the administration of the national park.

Manual Thinning: A method used to trim limbs from trees as well as cut down individual trees and other vegetation using a chainsaw, crosscut saw, or axe.

Mechanical Thinning: A method used to cut down trees and other vegetation using vehicles, equipment, and other specialized apparatus.

Mesic: Characterized by intermediate moisture conditions, neither decidedly wet nor decidedly dry. The mid- range of the moisture scale from wet to dry.

Metamorphic Rock: Rock that forms when sedimentary, igneous, or other metamorphic rock is heated and/or squeezed. Most metamorphic rocks form deep inside the Earth where heat and pressure are intense enough to change the shape of mineral crystals and even change one group of minerals into another.

Microbial Communities: Soil organisms capable of deriving carbon for growth and cell synthesis from organic compounds; includes bacteria, actinomycetes, fungi, and algae.

Mineral Soil: The portion of the soil profile immediately below the litter and duff layers. This portion contains very little combustible material except where an upper soil horizon may be enriched with organic matter.

Mop Up: Action that entails securing or cleaning up the fire after fireline is established (could be internal or around the perimeter).

Mosaic: Areas with a variety of plant communities over a landscape. For example, areas with trees and areas without trees occurring over a landscape.

Mutual Aid: A system wherein two or more fire departments, by prior agreement, operate essentially as a single agency to respond routinely across jurisdictional boundaries to render mutual assistance in combating fire emergencies.

Mycorrhizal: Refers to a mutually beneficial association between a fungus and the roots of a plant.

Native (Species): Any species of plant or animals native to a given land or water area by natural occurrence.

Natural Succession: The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

Noxious Weeds: Aggressive, non- native plant species that have been introduced. They can be difficult to manage, poisonous, toxic, parasitic, or carrier of insects or disease.

Nutrient Loading: The nutrient ***load*** refers to the total amount of nitrogen or phosphorus entering water during a given time, such as "tons of nitrogen per year." Nutrient ***loading*** is a large quantity of these nutreints that may enter the water from runoff, groundwater, or the air.

Nutrient Cycling: The passage of nutrients through an ecosystem so that they eventually become available once again to the primary producers.

Operational Plan: A written plan of action for a specific project or incident. Examples of operational plans could include burn plans, incident action plans, or non- fire treatment plans.

Overstory: Overstory is the larger, taller trees of growth which occupies a forest area and shades young trees, hardwoods, brush, and other deciduous varieties which are growing beneath the larger trees (i.e., understory).

PM 10 and 2.5: These are Particles found in the air. They can come in almost any shape or size, and can be solid particles or liquid droplets. One of the differences is size, we call the bigger particles PM10 and we call the smaller particles PM2.5.

Passive Crown Fire: An intense surface fire that torches occasional individual trees or small groups of trees, during this condition the surface fire is moving faster than the occasional torching of trees. Any spotting is usually short range less than ¼ mile and supports the surface fire spread.

Perennial: A plant which continues to grow after it has reproduced, usually meaning that it lives for several years.

Petroglyph: Pictures, symbols, or other artwork pecked, carved or incised on natural rock surfaces

Pictograph: A type of rock art in which a design is painted onto stone.

Pile Burning: Controlled burning of slash (trees, brush, branches) removed during thinning.
Porosity: The degree to which the total volume of soil, gravel, sediment, or rock is permeated with pores or cavities through which fluids (including air) can move.

Prescribed Fire or Burn: Any fire ignited by management actions to meet specific objectives. Prescribed fires are conducted in accordance with prescribed fire plans.

Prescribed Fire Plan: A plan for each prescribed fire. Plans are documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire will be conducted (a prescription).

Prescription: Measurable criteria that define the conditions under which a prescribed fire will be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, and environmental, geographic, administrative, social, or legal considerations.

Projects (or project areas):From the National Fire Plan Operations and Reporting System (NFPORS) A collection of Treatments and Activities. A Project is defined by the user but is generally considered to be the area of planning. All the Treatments in a Project are approved and conducted under a single NEPA decision document. A Project is persistent – it is not limited to any time period. A Project has a Centroid, a Name, and may be associated with the HFRA.

Propagules: The shoot, seed or other method that plants use to spread or propagate (reproduce).

Riparian Area: The area along a watercourse or around a lake or pond.

Roost: A place to rest or sleep.

Section 7: The section of the Endangered Species Act that requires all Federal agencies, in "consultation" with the Service, to insure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

Section 106 consultation: Refers to §106 of the National Historic Preservation Act, which requires federal agencies to take into account the effects of their proposed undertakings on properties included or eligible for inclusion in the National Register of Historic Places and give State Historic Preservation Officers/Tribal Historic Preservation Officers and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed undertakings.

Sedimentation: The accumulation of geological or organic material deposited by air, water, or ice.

Sensitive Species: Plant or animal species which are susceptible to habitat changes or impacts from activities.

Seral stage: Any stage of development of an ecosystem from a disturbed, un- vegetated state to a climax plant community.

Short- term Risk: A risk to be experienced within the next 10 to 15 years. For example, prescribed burns can disturb habitat in the short- term, but in the long- term the fire resiliency of the habitat may be improved.

Slash: Debris left as a result of forest and other vegetation being altered by forestry practices and other land use activities (e.g., timber harvesting, thinning and pruning, road construction, seismic line clearing). Slash includes material such as logs, splinters or chips, tree branches and tops, and uprooted stumps, trees and shrubs.

Snag: A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

Snagging: The act of cutting down standing dead trees which could fall over a fireline, or which are in an area where firefighters are working below.

Soil horizons: A layer of soil which can be distinguished from adjacent layers by characteristic physical properties such as texture, structure, or color, or by chemical composition.

Special Status Species: Species federally listed as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA); species that are proposed or are candidates for listing under ESA or federal species of concern that are not protected pursuant to ESA but are monitored for conservation status; and State of New Mexico listed threatened or endangered species and special status plant species.

Species: A class of individuals having common attributes and designated by a common name; a category of biological classification ranking immediately below the genus or subgenus; comprising related organisms or populations potentially capable of interbreeding.

Spike Camps: A camp is a geographical site(s), within the general incident area, separate from the incident base, equipped and staffed to provide sleeping, food, water, and sanitary services to incident personnel. Spike camps are generally small and highly temporary. These occur mostly in areas inaccessible by road and are frequently supplied by helicopter or pack- train.

Stand: A group of trees that occupies a specific area and is similar in species, age, and condition.

Stand- Replacing Fire: A fire that burns with sufficient intensity to kill the majority of living vegetation over a given area (grass and brush fires are stand replacement fires for that vegetation type, in forest vegetation types when 75- 80% of the stand is killed by fire are also considered stand replacement fires).

Surface fuels: All materials lying on or immediately above the ground including needles or leaves, duff, grass, small dead wood, downed logs, stumps, large limbs, low brush, and reproduction.

Synergistic: The action of two or more substances (or things) to produce an effect that neither alone could accomplish.

Taxa: Any grouping within the classification of organisms, such as species, genus, and order.

Tensile Strength: The ability of a structural material to withstand bending and stretching forces.

Threatened Species: Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Tractability: The trait of being easily persuaded.

Treatments: From the National Fire Plan Operations and Reporting System (NFPORS): The work activity that takes place on the Treatment Unit and is directly aimed at accomplishing goals of the National Fire Plan BARR or HFR. A Treatment is planned and conducted in one Fiscal Year.

Treatment Units: From the National Fire Plan Operations and Reporting System (NFPORS):
The tract of land where a *unique set* of Treatments is conducted. In the Hazardous Fuels Reduction module, Treatment Units are always 2- dimensional (Unit of Measure is acres). A Treatment Unit is persistent and has a Centroid (location). This means that once created, a Treatment Unit is permanently kept in the database.

Tuff: A rock composed of the finer kinds of volcanic detritus, usually fused together by heat.

Turbidity: A measure of water cloudiness caused by suspended solids.

Understory: The trees and woody shrubs growing beneath branches and foliage formed collectively by the upper portions of adjacent trees.

Values at Risk: A total assessment of resources, such as property, structures, natural and cultural resources, and economic, political, environmental, and social values, which may be affected by an incident now and in the foreseeable future.

Vegetation successional pathways: The process by which a series of different plant communities (and associated animals and microbes) successively occupy and replace each other over time in a particular ecosystem or landscape following a disturbance to that ecosystem. Includes the accompanying change in the nonliving environment (soil and microclimate).

Vesiculation: A process in which the volatiles dissolved in a glass such as obsidian are released, creating bubbles in the glass.

Viewshed: Everything visible from a particular vantage point.

Water Bars: A diagonal ditch or hump in a trail that diverts surface water runoff to minimize soil erosion.

Watershed: The entire region drained by a waterway, lake, or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

Wilderness: Wilderness is a congressionally mandated area withdrawn from location and entry under the US mining laws.

Wildland Fire: Any non- structural fire that occurs on wildlands that is not a prescribed fire.

Wildland Fire Implementation Plan (WFIP): A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefits. A full WFIP consists of three stages. Different levels of completion may occur for differing management strategies (i.e., fires managed for resource benefits will have two- three stages of the WFIP completed while some fires that receive a suppression response may only have a portion of Stage I completed).

Wildland Fire Use for a Resource Benefit: A natural (lightning) ignited fire that is managed to meet resource benefits.

Wildland Urban Interface: A line, area, or zone where structures and other human development meet or intermingle with undeveloped land or naturally occurring flammable fuels.

Wildlife Corridors: A strip or block of habitat connecting otherwise isolated units of suitable habitats that allow the dispersal of organisms and the consequent mixing of genes. A corridor is also beneficial to plant populations that have been isolated due to fragmentation.

APPENDIX B
ACRONYMS AND ABBREVIATIONS

A.D.	Anno Domini; in the year of the Lord (Latin); since the birth of Jesus Christ (used in designating dates)
APE	Area of Potential Effect
approx.	approximately
B.C.	Before Christ (used in designating dates).
BA	Biological Assessment
BO	Biological Opinion
BW	Backcountry/Wilderness
C	Celsius
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CG	Cerro Grande
CLI	Cultural Landscape Inventory
CO	Carbon Monoxide
DBH	Diameter at Breast Height
DFC	Desired Future Conditions
DO	Director's Order (refers to National Park Service Director)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
est.	estimate
FMP	Fire Management Plan
FRCC	Fire Regime Condition Class
ft.	feet
HQ	Headquarters
IDT	Inter- Disciplinary Team
LCES	Lookouts, Communications, Escape Routes and Safety Zones
LCS	List of Classified Structures
LF	Lower Frijoles
mi/hr	miles per hour
MIST	Minimum Impact Suppression Tactics
MMA	Maximum Manageable Area
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MTA	Minimum Tool Analysis
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Protection Act
NHPA	National Historic Preservation Act
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NO_2	Nitrogen dioxide
NOX	Nitrogen Oxide
NPS	National Park Service
NRZ	Nesting/Roosting Zone

O_3	Ozone
Pb	Lead
PM10	Particulate Matter with a diameter of 10 micrometers or less
PM2.5	Particulate matter with a diameter of 2.5 micrometers or less
PPb	Parts per billion
PPE	Personal Protective Equipment
PSD	Prevention of Significant Deterioration
RM- 18	National Park Service Reference Manual- 18: Wildland Fire Management
SHPO	State Historic Preservation Office
SNA	suitable nesting area
SO_2	Sulfur dioxide
TCP	Traditional Cultural Properties
U.S.	United States

APPENDIX C

FIRE HISTORY/ECOLOGY OF BANDELIER AND THE JEMEZ MOUNTAINS

Fire is considered a keystone natural process in maintaining the structural and functional integrity of Bandelier's vegetation communities. This concept is supported by numerous data sources, such as historic records and journals, aerial and ground- based photos, charcoal deposits from bogs, dendrochronological reconstructions of fire occurrence patterns and precipitation, and field sampling of soils and vegetation (Allen, 1995) (Allen, 2002). These extensive historic fire studies have produced detailed descriptions of the spatial and temporal variability in fire frequency, intensity, and extent in Bandelier and the Jemez Mountains. For example, fire scar samples from several different ponderosa pine sites in the Jemez Mountains recorded approximately 1,858 fire events and 221 different fire years over a 400- year period (between 1480 and 1899). The mean fire return interval (the average number of years between fire events) recorded for these sites was 5- 16 years (Touchan and Swetnam, 1995). In another study, conducted in the ponderosa pine forests within Bandelier, fire scar samples showed 113 separate fire years between 1480 and 1899 with fires averaging every 5- 15 years (Allen, et. al. 1995).

The frequent and widespread fire activity in Bandelier and the Jemez Mountains is primarily due to the high occurrence of lightning strikes. The southwest has the highest rate of lightning ignited fires in the United States (Swetnam and Baisan, 1996). 165,117 cloud- to- ground lightning strikes were recorded in a 775,554 ha area in the Jemez Mountains between the years of 1985- 1994 (Figure C.1). An average of sixty- two thunderstorm days per year are recorded in the area, producing between 9,410 and 23,317 lightning strikes annually (Allen, 2002). Accordingly, 86% of the historic fires recorded in Bandelier were the result of lightning strikes (Allen, 1984).

Lightning ignited fires occur most frequently in the warm and dry months of May and June, before the onset of the summer monsoonal rains. During these months, lightning strikes occur from clouds that release only virga (rain that evaporates before reaching the Earth's surface), offering an ignition source to dry fuels (Allen, 2002). Lightning strikes actually occur more during the monsoonal period (July- September) than in May and June. However, ignitions are less frequent because 40% of the area's annual precipitation (approximately 12- 35 inches, depending on elevation) is released during these storms and fuel moistures are generally higher. The El Nino-Southern Oscillation atmospheric phenomenon has comparable significant effects on fuels, resulting in increased fire occurrence and intensity. During the wet El Nino years the fine fuel production is increased and then becomes available for fire ignition and spread in the following dry La Nina year (Touchan and Swetnam, 1995).

Apparently the above mentioned climatic conditions and resulting fire and vegetation patterns developed 8,000- 11,000 years ago. Charcoal sediments from a bog in the Jemez Mountains provide evidence of persistent fire activity dating back at least 9,000 years (Allen, 2002).

Topographic features, such as slope aspect and steepness of slope, are also factors that contribute to the historic widespread fire activity in Bandelier. Research shows that slope aspect can significantly affect the occurrence of fire ignitions. Median fire return intervals on south facing slopes have been found to be shorter than on north facing slopes (Beaty and Taylor, 2001), suggesting that fires generally occur more frequently in areas with a southerly exposure, where

fuels tend to be drier. The steepness of a slope can affect the rate of fire spread and the extent of fires. Fire moving up a steep hill can dry the fuels ahead of its flaming front, allowing for faster fuel consumption and fire spread.

In summary, many factors, including a high concentration of lightning strikes, climatic conditions, and topography, make fire one of the dominant natural disturbance processes at Bandelier. Consequently, most of the vegetation communities and wildlife that have persisted through time are now fire- dependent.

Long- term Effects of Fire Suppression on Bandelier's Natural and Cultural Resources/Alteration of Bandelier's Fire Regimes

Fire regime is a term used to describe attributes, such as the frequency, intensity, extent, and duration, of a naturally occurring fire as it would typically burn in a particular vegetation community or landscape. One aspect of the fire regime that is of particular interest is fire frequency, which can vary greatly depending on the vegetation community. The frequency of naturally occurring fire in a specific vegetation community is typically expressed as an average range, called the *fire return interval*. For example, fires historically occurred an average of every 5-15 years in Bandelier's ponderosa pine forests (Allen et al., 1995). When these naturally occurring fires are regularly suppressed, the *fire return interval*, and therefore the natural *fire regime*, is disrupted. One way of describing or quantifying this disruption is by the *fire return interval departure,* defined as the number of *fire return intervals* that would have occurred naturally if fires had not been suppressed. A high departure from the natural fire regime indicates that the ecological integrity of the vegetation community or landscape may be compromised. This is the case at Bandelier National Monument.

Research shows that fire was a dominant natural force throughout the Jemez Mountains until the 1880's, when a variety of landuse practices such as extensive grazing and timber extraction began. After the cessation of grazing, fire would have continued to occur throughout the Jemez Mountains, but aggressive fire suppression efforts began in the early 1900's. The proliferation of these landuse practices resulted in near cessation of fires and, over time, has produced significant ecological effects on Bandelier's fire prone- landscapes. Today, after more than 100 years of active fire suppression, Bandelier's ecosystems are experiencing high accumulations of litter, duff, and dead and down woody fuels, increased tree densities, low herbaceous cover, decreased availability of soil nutrients, decreased plant productivity, increases in disease, insect infestations, and mortality in trees, loss of habitat, and increases in large stand replacing fires. Conflagrations like the 1977 La Mesa Fire, the 1996 Dome Fire, and the 2000 Cerro Grande Fire are becoming more frequent in ponderosa pine forests, where stand replacing fire events were once anomalous. In addition, subtle but important hydrological changes may be occurring because of increased forest growth. Decreased runoff and infiltration may be altering the water table around meadows, helping to accelerate tree invasions. The combination of high tree densities and increased forest fuels also increases the potential for insect and pathogen infestations, which may cause tree die- off and further increase the potential for fire. In the event of catastrophic fire, entire forest landscapes can be denuded and reverted to shrub communities, watershed and soil processes can be compromised, and other ecosystem values can be greatly altered.

Fire suppression has also affected many wildlife species by causing deterioration of their preferred habitats, and in some cases, by altering habitat that is critical for the survival of certain species. For example, the cover of many key herbaceous species is reduced in the absence of periodic fire and

the wildlife that depend on these plants have less available forage. Other species, such as woodpeckers, that depend on fire- created snags for food (insects) and shelter may suffer a decline in the absence of fire. These effects can also extend up the food chain. For example, meadows and other grassy areas that are maintained by periodic fire support rodent populations that are the prey base for many carnivorous species, such as owls. In the absence of fire, these rodent populations tend to decline, most likely causing a reduction in carnivorous populations.

An example of a departure from the natural fire regime of ponderosa pine follows:

Historically:

Fire history studies conducted at Bandelier indicate that before the 1880's frequent low intensity surface fires in ponderosa pine and some mixed conifer forests played a major role in maintaining species compositions and forest structures (Allen et al., 1995). The forests contained a full range of age classes, from seedlings, to mid- story trees, and overstory trees. Abundant grasses and forbs existed in the understory. Horizontal and vertical forest fuels were periodically consumed and maintained at low levels (5- 12 tons/acre), avoiding damage to soils and canopy root systems. Understory tree density was low, limiting the spread of fire into tree canopies, and therefore reducing the frequency of stand replacing fire events (Allen, 1989). Additional studies show that the approximate average size of these low intensity fires was 3,000 acres (Covington and More, 1992). (See Figure C.2 below of what a historic ponderosa pine forest in Bandelier may have looked like).

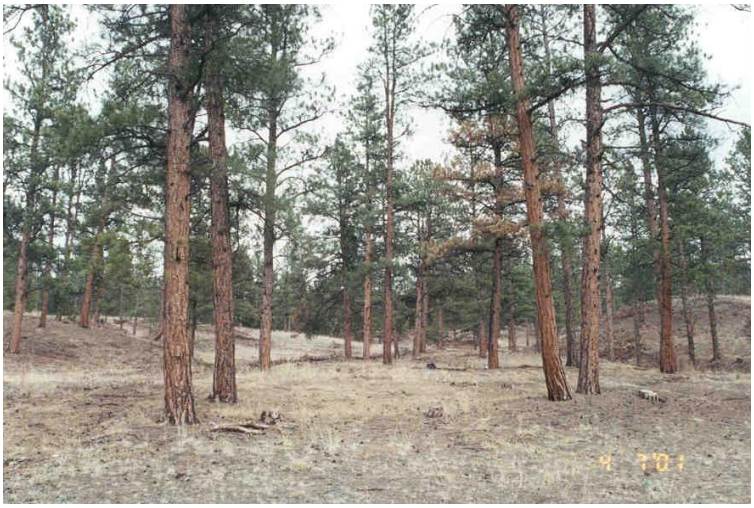


Figure C.2 An example of the possible structure of a historic ponderosa pine forest in Bandelier.

Current situation:

An assessment of forest structure at Bandelier shows that the absence of frequent, low intensity fire has altered and degraded Bandelier's ponderosa pine forests and some mixed conifer forests in many ways. The full range of age classes that existed historically has been replaced by extremely high densities of seedling trees (approximately 350 trees/acre) and mid- story trees (200 trees/acre). Herbaceous plant cover and productivity has decreased, as up- slope recruitment of pinyon and juniper trees and downslope recruitment of mixed conifer trees is observed. The fuel loading is recorded at approximately 33 tons/acre, much higher than the estimated 5- 12 tons/acre for historic conditions (NPS, unpublished data). It is clear that these current forest conditions, most notably the high accumulations of fuels and increased tree densities, have created the opportunity for the high intensity, high severity, stand replacing and stand destroying fires that are occurring today. The increased tree densities provide ladder fuels allowing fire into the tree canopies and the compacted litter and duff can cause a much longer fire residence time, increasing fire severity and possibly resulting in deleterious effects on soil properties as well as on the shallow rooted mature ponderosa pines. The approximate size of recent fires in ponderosa pine are: La Mesa Fire of 1977: 14,250 acres; Dome Fire of 1996: 16,500 acres; and the Cerro Grande Fire of 2000: 43,000 acres. (See Figure C.3 below for a photo of a current ponderosa pine forest in Bandelier.

Figure C.3 The current structure of a ponderosa pine forest in Bandelier.

APPENDIX D
MINIMUM IMPACT SUPPRESSION TACTICS

NWCG Guidance on Minimum Impact Suppression Tactics
In Response To the

IO- YEAR IMPLEMENTATION PLAN FOR REDUCING WILDLAND FIRE RISKS TO COMMUNITIES AND THE ENVIRONMENT

POLICY

The change from **fire control** to **fire management** has added a new perspective to the role of fire manager and the firefighter. Traditional thinking that "the only safe fire is a fire without a trace of smoke" is no longer valid. Fire Management now means managing fire "with time" as opposed to "against time." The objective of putting the fire dead out by a certain time has been replaced by the need to make unique decisions with each fire start to consider the land, resource and incident objectives, and to decide the appropriate management response and tactics which result in minimum costs and minimum resource damage.

This change in thinking and way of doing business involves not just firefighters. It involves all levels of management. Fire management requires the fire manager and firefighter to select management tactics commensurate with the fire's potential or existing behavior while producing the least possible impact on the resource being protected. The term used to describe these tactics is "Minimum Impact Suppression Tactics", commonly called MIST. Simply put: MIST is a 'do least damage' philosophy.

MIST is not intended to represent a separate or distinct classification of firefighting tactics but rather a mind set - how to suppress a wildfire while minimizing the long- term effects of the suppression action. MIST is the concept of using the minimum tool to safely and effectively accomplish the task. MIST should be considered for application on all fires in all types of land management.

While MIST emphasizes suppressing wildland fire with the least impact to the land, actual fire conditions and good judgment will dictate the actions taken. Consider what is necessary to halt fire spread and containment within the fireline or designated perimeter boundary, while safely managing the incident.

Use of MIST **will not** compromise firefighter safety or the effectiveness of suppression efforts. Safety zones and escape routes will be a factor in determining fireline location

Accomplishments of minimum impact fire management techniques originate with instructions that are understandable, stated in measurable terms, and communicated both verbally and in writing. They are ensured by monitoring results on the ground. Evaluation of these tactics both during and after implementation will further the understanding and achievement of good land stewardship ethics during fire management activities.

GUIDELINES

The intent of this guide is to serve as a checklist for all fire management personnel.Be creative and seek new ways to implement MIST.

INCIDENT MANAGEMENT CONSIDERATIONS

Fire managers and firefighters select tactics that have minimal impact to values at risk. These values are identified in approved Land or Resource Management Plans. Standards and guidelines are then tied to implementation practices which result from approved Fire Management Plans.

- Firefighter and public safety cannot be compromised.
- Evaluate suppression tactics during planning and strategy sessions to ensure they meet agency administrator objectives and MIST. Include agency Resource Advisor and/or designated representative.
- Communicate MIST where applicable during briefings and implement during all phases of operations.
- Evaluate the feasibility of Wildland Fire Use in conjunction with MIST when appropriate for achieving resource benefits.

RESPONSIBILITIES

Agency Administrator or Designee

- Ensure agency personnel are provided with appropriate MIST training and informational/educational materials at all levels.
- Communicate land and fire management objectives to Incident Commander.
- Periodically monitor incident to ensure resource objectives are met.
- Participate in incident debriefing and assist in evaluation of performance related to MIST.

Incident Commander

- Communicate land and fire management objectives to general staff.
- Evaluate suppression tactics during planning and strategy sessions to see that they meet the Agency Administrator's objectives and MIST guidelines.
- Monitor operations to ensure MIST is implemented during line construction as well as other resource disturbing activities.
- Include agency Resource Advisor and/or local representative during planning, strategy, and debriefing sessions.

Resource Advisor

- Ensure interpretation and implementation of WFSA/WFIP and other oral or written line officer direction is adequately carried out.
- Participate in planning/strategy sessions and attend daily briefings to communicate resource concerns and management expectations.
- Review Incident Action Plans (IAP) and provide specific direction and guidelines as needed.
- Monitor on the ground applications of MIST.
- Provide assistance in updating WFSA/WFIP when necessary.
- Participate in debriefing and assist in evaluation of performance related to MIST.

Planning Section

- Use Resource Advisor to help assess that management tactics are commensurate with land/resource and incident objectives.
- Ensure that instructions and specifications for MIST are communicated clearly in the IAP.
- Anticipate fire behavior and ensure all instructions can be implemented safely.

Logistics Section

- Ensure actions performed around Incident Command Post (ICP), staging areas, camps, helibases, and helispots result in minimum impact on the environment.

Operations Section

- Evaluate MIST objectives to incorporate into daily operations and IAP.
- Monitor effectiveness of suppression tactics in minimizing impacts to resources and recommend necessary changes during planning/strategy sessions.
- Communicate MIST to Division Supervisors and Air Ops/Support during each operational period briefing. Explain expectations for instructions listed in Incident Action Plan.
- Participate in incident debriefing and assist in evaluation of performance related to MIST.

Division/Group Supervisor and Strike Team/Task Force Leader

- Communicate MIST objectives and tactics to single resource bosses.
- Recommend specific tasks on divisions to implement MIST.
- Monitor effectiveness of suppression tactics in minimizing impacts to resources and recommend necessary changes to Operations Section Chief.

Single Resource Bosses

- Communicate MIST objectives to crew members.
- Monitor work to ensure that crews are adhering to MIST guidelines and specific incident objectives.
- Provide feedback to supervisor on implementation of MIST.

IMPLEMENTATION

Keep this question in mind: What creates the greater impact, the fire suppression effort or the fire?

Safety

- Apply principles of LCES to all planned actions.
- Constantly review and apply the 18 Watch Out Situations and 10 Standard Fire Orders.
- Be particularly cautious with:
  - Burning snags allowed to burn.
  - Burning or partially burned live and dead trees.
  - Unburned fuel between you and the fire.

Escape Routes and Safety Zones

- In any situation, the best escape routes and safety zones are those that already exist. Identifying natural openings, existing roads and trails and taking advantage of safe black will always be a preferred tactic compatible with MIST. If safety zones must be created, follow guidelines similar to those for helispot construction.

- Constructed escape routes and safety zones in heavier fuels will have a greater impact, be more time consuming, labor intensive and ultimately less safe.

General Considerations

- Consider the potential for introduction of noxious weeds and mitigate by removing weed seed from vehicles, personal gear, cargo nets, etc.
- Consider impacts to riparian areas when siting water handling operations.
  - Use longer draft hoses to place pumps out of sensitive riparian areas.
  - Plan travel routes for filling bladder bags to avoid sensitive riparian areas.
- Ensure adequate spill containment at fuel transfer sites and pump locations. Stage spill containment kits at the incident.

Fire Lining Phase

- Select tactics, tools, and equipment that least impact the environment.
- Give serious consideration to use of water or foam as a firelining tactic.
- Use alternative mechanized equipment such as excavators and rubber tired skidders rather than bulldozers when constructing mechanical line.
- Allow fire to burn to natural barriers and existing roads and trails.
- Monitor and patrol firelines to ensure continued effectiveness.

Ground Fuels

- Use cold- trail, wet line or combination when appropriate. If constructed fireline is necessary, use minimum width and depth to stop fire spread.
- Consider the use of fireline explosives (FLE) for line construction and snag falling to create more natural appearing firelines and stumps.
- Burn out and use low impact tools like swatters and gunny sacks.
- Minimize bucking to establish fireline: preferably move or roll downed material out of the intended constructed fireline area. If moving or rolling out is not possible, or the downed log/bole is already on fire, build line around it and let the material be consumed.

Aerial fuels–brush, trees, and snags:

- Adjacent to fireline: limb only enough to prevent additional fire spread.
- Inside fireline: remove or limb only those fuels which would have potential to spread fire outside the fireline.
- Cut brush or small trees necessary for fireline construction flush to the ground.
- Trees, burned trees, and snags:
  - Minimize cutting of trees, burned trees, and snags.
  - Do not cut live trees unless it is determined they will cause fire spread across the fireline or seriously endanger workers. Cut stumps flush with the ground.
  - Scrape around tree bases near fireline if hot and likely to cause fire spread.
  - Identify hazard trees with flagging, glowsticks, or a lookout.
- When using indirect attack:
  - Do not fall snags on the intended unburned side of the constructed fireline unless they are an obvious safety hazard to crews.
  - Fall only those snags on the intended burn-out side of the line that would reach the fireline should they burn and fall over.

Mopup Phase

- Consider using "hot- spot" detection devices along perimeter (aerial or hand- held).

- Use extensive cold- trailing to detect hot areas.
- Cold- trail charred logs near fireline: do minimal scraping or tool scarring. Restrict spading to hot areas near fireline.
- Minimize bucking of logs to check for hot spots or extinguish fire: preferably roll the logs and extinguish the fire.
- When ground is cool return logs to original position after checking.
- Refrain from piling: burned/partially burned fuels that were moved should be arranged in natural positions as much as possible.
- Consider allowing larger logs near the fireline to burn out instead of bucking into manageable lengths. Use a lever, etc. to move large logs.
- Use gravity socks in stream sources and/or combination of water blivets and fold-a- tanks to minimize impacts to streams.
- Personnel should avoid using rehabilitated firelines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work.
- Avoid use of non- native materials for sediment traps in streams.
- Aerial fuels (brush, small trees, and limbs): remove or limb only those fuels which if ignited have potential to spread fire outside the fireline.
- Burning trees and snags:
    - *Be particularly cautious when working near snags (*ensure adequate safety measures are communicated).
    - The first consideration is to allow a burning tree/snag to burn itself out or down.
    - Identify hazard trees with flagging , glow- sticks or a lookout.
    - If there is a serious threat of spreading firebrands, extinguish with water or dirt.
    - Consider felling by blasting, if available.

Aviation Management

Minimize the impacts of air operations by incorporating MIST in conjunction with the standard aviation risk assessment process.

- Possible aviation related impacts include:
    - Damage to soils and vegetation resulting from heavy vehicle traffic, noxious weed transport, and/or extensive modification of landing sites.
    - Impacts to soil, fish and wildlife habitat, and water quality from hazardous material spills.
    - Chemical contamination from use of retardant and foam agents.
    - Biological contamination to water sources, e.g., whirling disease.
    - Safety and noise issues associated with operations in proximity to populated areas, livestock interests, urban interface, and incident camps and staging areas.
- Helispot Planning
    - When planning for helispots determine the primary function of each helispot, e.g., crew transport or logistical support.
    - Consider using long- line remote hook in lieu of constructing a helispot.

- Consult Resource Advisors in the selection and construction of helispots during incident planning.
- Estimate the amount and type of use a helispot will receive and adapt features as needed.

- Balance aircraft size and efficiency against the impacts of helispot construction.
- Use natural openings as much as possible. If tree felling is necessary, avoid high visitor use locations unless the modifications can be rehabilitated. Fall, buck, and limb only what is necessary to achieve a safe and practical operating space.

Retardant, Foam, and Water Bucket Use

- Assess risks to sensitive watersheds from chemical retardants and foam. Communicate specific drop zones to air attack and pilots, including areas to be avoided.
- Fire managers should weigh use of retardant with the probability of success by unsupported ground force. Retardant may be considered for sensitive areas when benefits will exceed the overall impact. This decision must take into account values at risk and consequences of expanded fire response and impact on the land.
- Consider biological and/or chemical contamination impacts when transporting water.
- Limited water sources expended during aerial suppression efforts should be replaced. Consult Resource Advisors prior to extended water use beyond initial attack.

Logistics, Camp Sites, and Personal Conduct

- Consider impacts on present and future visitors.
- Provide portable toilets at areas where crews are staged.
- Good campsites are found, not made. If existing campsites are not available, select campsites not likely to be observed by visitors
- Select impact- resistant sites such as rocky or sandy soil, or openings within heavy timber. Avoid camping in meadows and along streams or shores.
- When there is a small group try to disperse use. In the case of larger camps: concentrate, mitigate, and rehabilitate.
- Lay out camp components carefully from the start. Define cooking, sleeping, latrine, and water supplies.
- Prepare bedding and campfire sites with minimal disturbance to vegetation and ground.
- Personal Sanitation:
  - Designate a common area for personnel to wash up. Provide fresh water and biodegradable soap.
  - Do not introduce soap, shampoo or other chemicals into waterways.
  - Dispose of wastewater at least 200 feet from water sources.
  - Toilet sites should be located a minimum of 200 feet from water sources. Holes should be dug 6- 8 inches deep.
  - If more than 1 crew is camped at a site strongly consider portable toilets and remove waste.
- Store food so that it is not accessible to wildlife, away from camp and in animal resistant containers.

- Do not let garbage and food scraps accumulate in camp.
- Monitor travel routes for damage and mitigate by:
  - Dispersing on alternate routes or
  - Concentrating travel on one route and rehabilitate at end of use.
- If a campfire is built, leave no trace of it and avoid using rock rings. Use dead and down wood for the fire and scatter any unused firewood. Do not burn plastics or metal.

Restoration and Rehabilitation

- Firelines:
  - After fire spread has stopped and lines are secured, fill in deep and wide firelines and cup trenches and obliterate any berms.
  - Use waterbars to prevent erosion, or use woody material to act as sediment dams.

Maximum Waterbar Spacing	
Percent Grade	Maximum Spacing, Feet
< 9	400
10 – 15	200
15 – 25	100
25 +	50

Table 1, Maximum Waterbar spacing.

  - Ensure stumps are cut flush with ground.
  - Camouflage cut stumps by flush- cutting, chopping, covering, or using FLE to create more natural appearing stumps.
  - Any trees or large size brush cut during fireline construction should be scattered to appear natural.
  - Discourage the use of newly created firelines and trails by blocking with brush, limbs, poles, and logs in a naturally appearing arrangement.
- Camps:
  - Restore campsite to natural conditions.
  - Scatter fireplace rocks and charcoal from fire, cover fire ring with soil, and blend area with natural cover.
  - Pack out all garbage.
- General:
  - Remove all signs of human activity.
  - Restore helicopter landing sites.
  - Fill in and cover latrine sites.
- Walk through adjacent undisturbed areas and take a look at your rehab efforts to determine your success at returning the area to as natural a state as possible.

APPENDIX E

Multi-year Fuels Plan (Timeline)

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
UF-9B **Al Ayers** -Contract Prep -Compliance **UF-9C** **West Ski Trail** -Cut/Haul -Pile Burn -Oversight **UF-9E** **Inholdings** **Phase 1** -Cut/Haul -Pile Burn -Compliance -Oversight **Entrance** **Road Phase 2** -Cut/Haul	**UF-9A** **East Ski Trail** -Compliance -Monitoring -Evaluation -Media support - Prep -Oversight -RX Burn **UF-9B** **Al Ayers** -RX Burn -Oversight -Media support - Monitoring **UF-9C** **West Ski Trail** -Contract Prep -RX Burn **UF-9E** **Inholdings** **Phase 2** -Cut/Haul -Pile Burn -Compliance **UF-7A** -Compliance -Prep **UF-7B** -Compliance **CG-1A** -Compliance -Prep	**UF-9E** **Inholdings** -RX Burn -monitor/eval **CG-1A** -RX Burn -monitor/eval **UF-7A** -RX Burn -monitor/eval **UF-7B** -Cut/Haul -Pile Burn **CG-5/8** -Compliance -Prep **HQ-41** **HQ to Alcove** -Compliance -Prep **UF-9F** -Compliance -Prep **UF-9D** -Compliance -Prep **UF-14** -Compliance	**HQ-41** **HQ to Alcove** -RX Burn -monitor/eval **CG-5/8** -RX Burn -monitor/eval **UF-9F** -RX Burn -monitor/eval **UF-14** -Contract Thinning -Pile Burn **CG-1B** -Compliance -Prep **HQ-44** **Falls Trail** -Compliance -Prep	**UF-9D** -Rx Burn -monitor/eval **CG-1B** -RX Burn -monitor/eval **HQ-44** **Falls Trail** -RX Burn -monitor/eval **UF-14A** -Prep **UF-14B** -Prep **CG-1C** -Compliance -Prep **UF-12** -Compliance	**CG-1C** -RX Burn -monitor/eval **UF-14A** -RX Burn -monitor/eval **UF-14B** -RX Burn -monitor/eval **UF-14C** -Prep **UF-12A** -Prep **UF-12B** -Prep **UF-27** -Compliance -Prep	**UF-14C** -RX Burn -monitor/eval **UF-27** -RX Burn -monitor/eval **UF-12A** -RX Burn -monitor/eval **UF-12B** -RX Burn -monitor/eval **UF-12C** -Prep **UF-12D** -Prep **LF-30** -Compliance -Prep	**UF-12C** -RX Burn -monitor/eval **UF-12D** -RX Burn -monitor/eval **LF-30** -RX Burn -monitor/eval **UF-12E** -Prep **UF-12F** -Prep **LF-28** -Compliance -Prep **LF-29** -Compliance -Prep	**UF-12E** -RX Burn -monitor/eval **UF-12F** -Rx Burn -monitor/eval **LF-28** -RX Burn -monitor/eval **LF-29** -RX Burn -monitor/eval **HQ-45A** -Compliance -Prep **LF-38** -Compliance -Prep	**LF-38** -RX Burn -monitor/eval **HQ-45A** -RX Burn -monitor/eval **HQ-45B** -Compliance -Prep **HQ-45C** -Compliance - Prep **UF-7B** -Prep **UF-7C** -Compliance -Prep

Refer to Figure 2.2 and 2.3 for location of projects.

UF= Upper Frijoles
CG=Cerro Grande
HQ=Headquarters
LF=Lower Frijoles

APPENDIX F
HISTORICAL LANDUSE AND VEGETATION RESOURCE IMPACTS

The vegetation resources within Bandelier National Monument have been profoundly affected by historic land use practices common throughout much of the western United States. Essentially all of the vegetation types in the park have been altered, to some degree, by the effects of historic grazing and active suppression of wildfires (Allen, 1989). Some communities have undergone relatively minor structural changes which can be reversed through iterative mechanical and fire treatments, while others have experienced more permanent changes in both species composition and functionality.

Fire suppression precipitated fundamental changes in plant community structure and composition: it indirectly provided the continuous ladder and crown fuels necessary to support large scale crown fire in ponderosa forests, supported increased densities of trees in pinyon- juniper woodlands which has precipitated accelerated erosion, and allowed progressive encroachment of woody plants in former meadow and grassland systems.

Around 1880, historic land use activities (i.e. logging, fuel- wooding, grazing, hunting, and fire suppression) intensified and began to noticeably affect plant communities. Ponderosa and mixed coniferous forests were timbered, fence posts and fuel wood were extracted from accessible woodlands, fires were suppressed, and the entire landscape was intensively grazed by domestic livestock. Beginning around 1916, many of these consumptive activities ceased, although cattle grazing continued through 1940 and a population of feral burros was present until the mid- 1980's. During the last five hundred years, local plant communities have been shaped by intermittent human land- use; extant plant communities at Bandelier are a product of this history of human use and disturbance, and disruption or alteration of communities and processes.

Increases in woody plant density across the landscape is the major legacy of historic grazing and fire suppression activities. More recently, the alteration of water regimes along the Rio Grande corridor resulting from irrigation, flood and sediment control activities has affected riparian habitat. Beginning in the early 1980's, park lands below 5460 feet (1664 meters) in White Rock Canyon along the Rio Grande have been seasonally inundated by Cochiti Reservoir in the context of flood and sediment control by the operation of Cochiti Dam. Extended periods of inundation during the mid- 1980's killed all living vegetation within the flood zone and deposited many feet of silt. Native soils and natural habitats were altered; cottonwood bosques, springs and seeps and other riparian settings were displaced with sterile mudflats and subsequent dense growth of agricultural weeds.

APPENDIX G

LIST OF SELECTED WILDLIFE SPECIES BY VEGETATION COMMUNITY THAT ARE PRESENT IN BANDELIER

	Vegetation Community							
	Montane Grasslands	Aspen Groves	Mixed Conifer	Ponderosa Pine	Pinyon-Juniper	Juniper-Shrub Grasslands	Canyon Slope Complex	Canyon Bottom Complex
Birds								
Acorn woodpecker		Y	Y	Y	Y	Y		Y
American kestrel	Y	Y	Y	Y	Y	Y	Y	Y
American robin	Y	Y	Y	Y	Y		Y	Y
American three- toed woodpecker		Y	Y	Y	Y		Y	Y
Ash- throated flycatcher				Y	Y	Y	Y	Y
Band- tailed pigeon		Y	Y	Y	Y	Y	Y	Y
Bewick's wren		Y	Y	Y	Y	Y	Y	Y
Black swift	Y	Y	Y	Y	Y		Y	Y
Black- capped chickadee	Y	Y	Y	Y	Y			Y
Black- chinned hummingbird		Y		Y	Y	Y		Y
Black- headed grosbeak		Y	Y	Y	Y	Y		Y
Black- throated grey warbler				Y	Y	Y		Y
Blue- grey gnatcatcher					Y	Y	Y	Y
Brewer's sparrow					Y	Y	Y	Y
Broad- tailed hummingbird	Y	Y	Y	Y	Y		Y	Y
Brown creeper		Y	Y	Y	Y		Y	Y
Bushtit		Y	Y	Y	Y	Y	Y	Y
Canyon wren				Y	Y	Y	Y	Y
Cassin's kingbird				Y	Y	Y	Y	Y
Chipping sparrow	Y	Y	Y	Y	Y	Y	Y	Y
Common raven	Y	Y	Y	Y	Y	Y	Y	Y
Cooper's hawk	Y	Y	Y	Y	Y	Y	Y	Y
Cordilleran flycatcher		Y	Y	Y	Y	Y	Y	Y
Dark- eyed junco	Y	Y	Y	Y	Y	Y	Y	Y
Downy woodpecker		Y	Y	Y	Y			Y
Dusky flycatcher		Y	Y	Y	Y	Y	Y	Y
Flammulated Owl		Y	Y	Y	Y	Y	Y	Y
Grace's warbler			Y	Y				Y
Great horned owl	Y	Y	Y	Y	Y	Y	Y	Y
Green- tailed towhee	Y	Y	Y	Y	Y	Y	Y	Y
Hairy woodpecker		Y	Y	Y	Y		Y	Y
Hammond's flycatcher		Y	Y	Y	Y	Y	Y	Y
Hepatic tanager			Y	Y	Y	Y	Y	Y
Hermit thrush		Y	Y	Y	Y		Y	Y
House finch			Y	Y	Y	Y	Y	Y

House wren	Y	Y	Y	Y	Y	Y	Y	Y
Juniper titmouse				Y	Y	Y	Y	Y
Lesser goldfinch				Y	Y	Y	Y	Y
Lewis's woodpecker			Y	Y	Y		Y	Y
Mexican spotted owl		Y	Y	Y				
Mountain bluebird	Y	Y	Y	Y	Y	Y	Y	Y
Mountain chickadee	Y	Y	Y	Y	Y	Y	Y	Y
Northern flicker	Y	Y	Y	Y	Y	Y	Y	Y
Northern goshawk	Y	Y	Y	Y	Y			
Peregrine Falcon		Y	Y	Y	Y	Y	Y	
Pinyon jay				Y	Y	Y	Y	
Plumbeous vireo (Solitary)		Y	Y	Y	Y	Y	Y	Y
Pygmy nuthatch		Y	Y	Y				
Red- naped sapsucker		Y	Y	Y	Y		Y	Y
Say's phoebe				Y	Y	Y	Y	Y
Stellar's jay		Y	Y	Y	Y	Y	Y	
Violet- green swallow	Y	Y	Y	Y	Y	Y	Y	Y
Virginia'a warbler		Y	Y	Y	Y	Y	Y	Y
Warbling vireo		Y	Y	Y	Y	Y	Y	Y
Western bluebird		Y	Y	Y	Y	Y	Y	Y
Western scrub- jay			Y	Y	Y	Y	Y	Y
Western tanager		Y	Y	Y	Y	Y	Y	Y
Western wood- peewee			Y	Y	Y	Y	Y	Y
White- breasted Nuthatch		Y	Y	Y	Y	Y	Y	Y
White- throated swift	Y	Y	Y	Y	Y	Y	Y	Y
Williamson's sapsucker		Y	Y	Y	Y	Y	Y	Y
Yellow- rumped warbler	Y	Y	Y	Y	Y	Y	Y	Y
Mammals								
Abert's squirrel			Y	Y	Y	Y		
American marten	Y	Y	Y	Y				
Audubon's desert cottontail					Y	Y	Y	Y
Badger	Y	Y	Y	Y	Y	Y	Y	Y
Big brown bat			Y	Y	Y			
Black bear		Y	Y	Y	Y	Y	Y	Y
Black- tailed jackrabbit			Y	Y	Y	Y	Y	
Bobcat	Y		Y	Y	Y	Y	Y	Y
Botta's pocket gopher	Y		Y	Y	Y	Y	Y	
Brazilian (Mexican) free- tailed bat			Y	Y	Y	Y	Y	
Brush mouse	Y	Y	Y	Y	Y	Y	Y	Y
Colorado chipmunk		Y	Y	Y	Y	Y	Y	
Coyote	Y	Y	Y	Y	Y	Y	Y	Y
Deer mouse	Y	Y	Y	Y	Y	Y	Y	Y
Elk	Y	Y	Y	Y	Y	Y	Y	
Fringed myotis			Y	Y	Y	Y	Y	
Golden- mantled ground squirrel	Y	Y	Y	Y	Y	Y	Y	
Gray fox			Y	Y	Y	Y	Y	Y
Hoary bat				Y	Y	Y		

Long- eared myotis			Y	Y	Y	Y		
Montane vole	Y	Y	Y	Y	Y			
Mule deer	Y	Y	Y	Y	Y	Y	Y	Y
Nothern pocket gopher	Y	Y	Y	Y				
Pallid bat				Y	Y	Y	Y	
Pinyon mouse					Y	Y	Y	
Porcupine	Y	Y	Y	Y	Y	Y	Y	Y
Raccoon	Y	Y	Y	Y	Y	Y	Y	Y
Red squirrel			Y	Y				
Ringtail			Y	Y	Y	Y	Y	
Rock squirrel			Y	Y	Y	Y	Y	
Silky pocket mouse					Y	Y	Y	
Silver- haired bat		Y	Y	Y	Y	Y	Y	
Striped skunk	Y	Y	Y	Y	Y	Y	Y	Y
White- throated woodrat					Y	Y	Y	Y
Yuma myotis					Y	Y	Y	Y
Amphibians								
Jemez Mountains salamander		Y	Y	Y				
Tiger salamander	Y	Y	Y	Y				Y
Red spotted toad			Y	Y	Y	Y	Y	Y
Woodhouse's toad					Y	Y	Y	
Canyon treefrog					Y	Y	Y	Y
Striped chorus frog		Y	Y	Y	Y	Y	Y	
Reptiles								
Checkered whiptail					Y	Y	Y	
Chihuahua whiptail			Y	Y	Y	Y	Y	
Collared lizard			Y	Y	Y	Y	Y	
Eastern fence lizard				Y	Y	Y	Y	
Gopher (bull) snake			Y	Y	Y	Y	Y	
Many- lined skink		Y	Y	Y	Y	Y	Y	
Plateau whiptail				Y	Y	Y	Y	
Ringneck snake			Y	Y	Y	Y	Y	
Striped whipsnake			Y	Y	Y	Y	Y	
Tree lizard			Y	Y	Y	Y	Y	
Western diamondback rattlesnake			Y	Y	Y	Y	Y	
Western terrestrial garter snake	Y	Y	Y	Y	Y	Y	Y	Y

Source: Brown 1994, Cook et al. 2000,
Fettig et al. 2003, NPS 1992, 1999

APPENDIX H
EA/ASSESSMENT OF EFFECT MAILING LIST

Dave Foreman

David Leland
801 7th Street
Los Alamos, NM 87544

Bill Partain
83 Barcelona Ave
Los Alamos, NM 87544

Maribeth Engbert
2173A 36th Street
Los Alamos, NM 87544

Leslie Hansen
4012 A Sycamore
Los Alamos, NM 87544

Charles Foxx
412 Rover Blvd
Los Alamos, NM 87544

Rainer and Ilse Bleck
1007 Big Rock Loop
Los Alamos, NM 87544

Cecil E. Bingham
1309 47th Street
Los Alamos, NM 87544

John Lissoway
53 La Paloma Dr.
Los Alamos, NM 87544

Carl Sykes
15700 Kanawha Court
Derwood, MD 20855

Roberta J. Shaw
4920 Sandia Drive
Los Alamos, NM 87544

Chairperson Nona Bowman
Los Alamos County Council
P. O. Box 30
Los Alamos, NM 87544

Randy Balice
Tiffany Ct.
Los Alamos, NM 87544

Diane Albert
4781 Quemazon
Los Alamos, NM 87544

State Director Linda Rundell
Bureau of Land Management
P. O. Box 27115
Santa Fe, NM 87502- 0115

Emergency Management Coordinator Phil Taylor
County of Los Alamos
P.O. Box 30
Los Alamos, NM 87544

Forest Guardians
312 Montezuma, Suite A
Santa Fe, NM 87501

Laura McCarthy
Forest Trust
P. O. Box 519
Santa Fe, NM 87504

Martha Anne Freeman
Friends of Bandelier
2846 Plaza Rojo
Santa Fe, NM 87544

Director Dorothy Hoard
Friends of Bandelier
11 Los Arboles Dr.
Los Alamos , NM 87544

Los Alamos Chamber of Commerce
109 Central Park Square
Los Alamos, NM 87544
County Administrator
Los Alamos County
P.O. Box 30
Los Alamos, NM 87544

Fire Management Specialist Bob Lineback
National Park Service , Intermountain Region
P.O. Box 728
Santa Fe, NM 87504- 0728

Fire Chief Douglas MacDonald
Los Alamos Fire Department
195 East Road, Suite 101
Los Alamos, NM 87544

Sam Loftin
Los Alamos National Laboratory

NHPA/NEPA Specialist Vicki D. Loucks
Los Alamos National Laboratory
Facility Operations
528 35th St., MS A- 316
Los Alamos, NM 87544

Director Pete Nanos
Los Alamos National Laboratory

Gene Darling
Los Alamos National Laboratroy
Box 1663, MS C938
Los Alamos, NM 87545

Mesa Public Library
Public Documents
2400 Central
Los Alamos, NM 87544

David Henderson
National Audubon - New Mexico
P. O. Box 9314
Santa Fe, NM 87504

Regional Solicitor Robert Easton
National Park Service
Southwest Region
P. O. Box 1042
Santa Fe, NM 87504- 1042

Senator Phil Griego
New Mexico State Senate
Box 10
San Jose, NM 87565

Senator Carlos R. Cisneros
New Mexico State Senate
P.O. Box 1129
Questa, NM 87556

Senator John Grubesic
New Mexico State Senate
36 Star Vista Road
Santa Fe, NM 87505

Fire Management Specialist L. Dean Clark
National Park Service, Intermountain Region
12795 W. Alameda Parkway
P.O. Box 25287
Denver, CO 80225- 0287

Chris Turk
National Park Service, Intermountain Region
12795 W. Alameda Parkway
P.O. Box 25287
Denver, CO 80335- 0287

Fire Ecologist Linda Kerr
National Park Service, Intermountain Region
P.O. Box 25287
Denver, CO 80225- 0287

Regional FMO Bryan Swift
National Park Service, Intermountain Region
12795 W. Alameda Parkway
P.O. Box 25287
Denver, CO 80225- 0287

Representative Jeanette Wallace
New Mexico House of Representatives
1913 Spruce
Los Alamos, NM 87544

Senator Richard C. Martinez
New Mexico State Senate
P.O. Box 934
Espanola, NM 87532

Senator Leonard Tsosie
New Mexico State Senate
P.O. Box 1003
Crownpoint, NM 87313

Habitat Specialist Steve Anderson
NM Game and Fish
Northwest Area Operations
3841 Midway Pl NE
Albuquerque, NM 87109

FMO Nancy Neskauskas
NM State Forestry
P.O. Box 1948
Santa Fe, NM 87504

State Forester Butch Blazer
NM State Forestry
P.O. Box 1948
Santa Fe, NM 87504- 1948

Inventory Coordinator Michael Scialdone
New Mexico Wilderness Alliance
202 Central SE, Suite 101
Albuquerque, NM 87102

Director Bruce Thompson
NM Department of Game & Fish
P. O. Box 25112
Santa Fe, NM 87504

Richard Ryan
NM Earth First!
456 Amado St.
Santa Fe, NM 87501

Secretary Joanna Prokop
NM Energy, Minerals & Natural Resources Dept.
1220 South St. Francis Dr.
Santa Fe, NM 87505

Bureau Chief Marcy Leavitt
NM Environ Dept SWQB
P. O. Box 26110
Santa Fe, NM 87505

Secretary Ron Curry
NM Environment Department
P. O. Box 26110
Santa Fe, NM 87502- 6110

Governor Randolph Padilla
Pueblo of Jemez
P.O. Box 100
Jemez Pueblo, NM 87024

Governor Lawrence Troncosa
Pueblo of San Felipe
P.O. Box 4339
San Felipe, NM 87001

Governor Elmer Torres
Pueblo of San Ildefonso
Rout 5, Box 315- A
Santa Fe, NM 87501

Governor Gilbert Tofoya
Pueblo of Santa Clara
P.O. Box 580
Espanola, NM 87532

State Historic Preservation Officer Katherine Slick
NM State Historic Preservation Office
228 E. Palace
Santa Fe, NM 87501

Director Dave Simon
NM State Parks
P.O. Box 1147
Santa Fe, NM 87504

NM Wildlife Federation
2921 Carlisle NE Suite 200- J
Albuquerque, NM 87110

Northern New Mexico Community College
Office of the President
921 Paseo de Onate
Espanola, NM 87532

Governor Bill Richardson
Office of the Governor
State Capitol
Santa Fe, NM 87503

Simon Suina
Pueblo of Cochiti
P. O. Box 70
Cochiti, NM 87072

Governor Joseph Quintana
Pueblo of Cochiti
P.O. Box 70
Cochiti, NM 87072

Thomas & Carolyn Jervis
Sangre de Cristo Audubon Society
60 Barranca Rd.
Los Alamos, NM 87544

President Jim McLaughlin
Santa Fe Community College
Office of the President
6401 Richards Ave.
Santa Fe, NM 87508

Fire Chief Stan Holden
Santa Fe County
35 Camino Justicia
Santa Fe, NM 87508

Governor Vidal Aragon
Pueblo of Santo Domingo
P.O. Box 99
Santo Domingo, NM 87052

Governor Donald Eriacho
Pueblo of Zuni
P.O. Box 339
Zuni, NM 87327

Rio Arriba County Commissioners
P. O. Box 1256
Espanola, NM 87532

Sandoval County Commissioners
P. O. Box 40
Bernalillo, NM 87004

Thomas Ribe
Southwest Headwaters
P. O. Box 31151
Santa Fe, NM 87594

The Nature Conservancy
New Mexico Chapter
212 E. Marcy
Santa Fe, NM 87501

Senator Jeff Bingaman
U. S. Senate
Attention: Helen Dorado- Gray
119 E. Marcy, #101
Santa Fe, NM 87501

Congressman Tom Udall
U.S. House of Representatives
502 Cannon House Office Building
Washington, DC 20515- 3103

Congresswoman Heather Wilson
U.S. House of Representatives
226 Cannon House Office Building
Attn: Kristen Astor
Washington, DC 20515

Senator Jeff Bingaman
U.S. Senate
Attention: Scott K. Miller, Legislative Counsel
Washington, DC

Santa Fe County Commissioners
P. O. Box 1985
Santa Fe, NM 87501

Fire Staff Officer Paul Orozco
Santa Fe National Forest
P.O. Box 1689
Santa Fe, NM 87504

Assistant Fire Staff Tom Johnston
Santa Fe National Forest
P.O. Box 1689
Santa Fe, NM 87504

Assistant Fire Staff Jesus Lucero
Santa Fe National Forest
P.O. Box 1689
Santa Fe, NM 87504

Sierra Club - Pajarito Group
P. O. Box 945
Los Alamos, NM 87544

LTC Dana R. Hurst
US Army Corps of Engineers
Albuquerque, CESPA
P. O. Box 1580
Albuquerque, NM 87103- 1580

Compliance Officer Elizabeth Withers
US Department of Energy
NNSA Office of Facility Operations
528 35th St.
Los Alamos, NM 87544

T&E Specialist
US Fish & Wildlife Service
2105 Osuna Rd., NE
Albuquerque, NM 87113

Ecologist Mark Kaib
US Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

Forest Supervisor Gilbert Zepeda
US Forest Service
Santa Fe National Forest
1474 Rodeo Rd.
Santa Fe, NM 87505

Senator Pete Domenici U.S. Sentate SH- 328 Hart Senate Building Washington, DC 20510- 3101 President Louis Caldera University of New Mexico Office of the President Scholes Hall 160 Albuquerque, NM 87131 Executive Director Ray Powell Valles Caldera National Preserve 2201 Trinity Dr. Los Alamos, NM 87544 Dennis Trujillo Valles Caldera National Preserve 2201 Trinity Dr. Los Alamos, NM 87544 President Robert E. (Bob) Howard, MD, PhD Wildlands Project 14 Reno Place Santa Fe, NM 87508	Ecosystem Specialist Charles Jankiewicz US Forest Service Santa Fe National Forest 1474 Rodeo Rd. Santa Fe, NM 87505 District Ranger John Peterson US Forest Service Jemez Ranger District P. O. Box 150 Jemez Springs, NM 87025 District Ranger John Miera US Forest Service Espanola Ranger District P. O. Box 3307 Espanola, NM 87532